MONTHLY WEATHER REVIEW,

NOVEMBER, 1878.

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In compiling the present REVIEW the following data, received up to December 14th, have been made use of, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 119 Signal Service stations and 11 Canadian stations, as telegraphed to this office; monthly journals and means, 117 and 141 respectively, from the former, and monthly means from 13 of the latter; reports from 22 special Sunset stations; 228 monthly registers from Voluntary Observers; 40 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers and local Weather Services of the States of Iowa and Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon chart No. II is shown by the isobaric lines the general distribution of the atmospheric pressure, reduced to sea-level, for the month. Compared with the means for October of previous years, the pressure for the present month is slightly above normal west of the Rocky Mountains, and slightly below east of that region, the greatest deficiency is over the New England States.

The Local Barometric Ranges for the month, as reduced to sea-level, have been largest over New England and the Middle States, from which region they have gradually decreased south and westward to the Gulf and Pacific coasts. Taken by districts, they vary as follows:—New England, 1.60 inches at Boston and Springfield to 1.40 at Burlington and 1.18 on the summit of Mt. Washington; Middle States, 1.60 at Sandy Hook to 1.36 at Lynchburg; South Atlantic States, 1.08 at Cape Lookout to 0.69 at Jacksonville and 0.67 at Tybee Island; Gulf States, 0.75 at Montgomery to 0.61 at Indianola, and 0.39 at Key West; Ohio valley and Tennesse, 1.20 at Pittsburgh to 0.87 at Cairo; Lake region, 1.41 at Oswego to 0.84 at Duluth; Upper Mississippi valley and Minnesota, 0.97 at Des Moines to 0.83 at St. Paul, and 0.90 at Pembina; Missouri valley, 1.06 at Yankton to 0.80 at Bismarck; eastern slope of Rocky Mountains and interior of Texas, 0.96 at North Platte to 0.63 at Deadwood, Dak., and 0.47 at Fort Davis, Tex.; Rocky Mountain stations, 0.63 at Virginia City, Mont., to 0.45 at Cheyenne; 0.58 on summit of Pike's Peak; Western Plateau, 0.84 at Boise City to 0.70 at Pioche; California, 0.75 at Red Bluff to 0.57 at San Diego.

Areas of High Barometer.—Nine of these have been well marked areas, and a brief description of each is given below. Three of them, Nos. II., III. and V., first appeared over the Northwest; four, Nos. IV., VII., VIII. and IX., over Oregon and Washington Territory, and one, No. VI., over California. Their paths were similar, those appearing in the Northwest moving eastward over the Lake region, Ohio valley and Atlantic States, while those first appearing on the Pacific coast moved southeastward over the Rocky Mountains and Southwest, and thence spread over the Gulf States.

No. I—is a continuation of high area No. VI of the October REVIEW, and was central over the Southern States during the 1st and 2nd, where it was accompanied by clear, frosty weather; on the morning of the 1st the minimum temperatures of the month were experienced at stations from Illinois and Ohio to the South Atlantic coast, and ranged from 24° at Columbus, Ohio, to 41° at Jacksonville, Florida.

No. II—advanced southward over Montana and Wyoming on the 1st in rear of low area No. II, then central north of the Lake region. 2nd, a general rise in pressure occurred over the entire country, and during the 3rd the pressure was everywhere above the normal, except on the immediate Pacific coast, in advance of low area No. V. Rising temperature prevailed, except from the Lower Lakes to the Atlantic coast. 4th, pressure above normal east of the Mississippi, with maximum pressure over Lake region; barometer falling in the Northwest, in advance of low area No. IV, which was subsidiary to area No. V on the Pacific coast. 5th, passed southeastward off the South Atlantic coast.

No. III—advanced southward over Manitoba and the Northwest on the 6th, separating low areas Nos. IV and V, the former being transferred to the Atlantic coast, the latter remaining central in Nevada. 7th, moved southward into the Missouri valley; lower temperatures, fog, rain and snow prevailed in Colorado and New Mexico, and low area No. V was apparently pushed back toward the California coast. 8th, moved eastward over the Mississippi valley, followed by heavy snow and rain in Colorado and New Mexico, as low area No. V advanced eastward. 9th, was east of the Mississippi, with falling pressure. 10th, was probably dissipated by the joint influence of low areas Nos. V (over the Upper Mississippi valley) and III (over Nova Scotia.)

No. IV—appeared over Oregon on the 9th, and extended eastward on the 10th to the northwest and west of low area No. V. 11th, moved southeastward over the Rocky Mountains, preceded by northerly winds west of the Mississippi, increasing to high, with light rains, on the coast of Texas; Indianola, 7:12 a. m., N. 32, and Galveston, 10:30 p. m., NW. 27. 12th, central over the Southwest, with falling barometer and frosty weather, and, on the 13th, was probably dissipated in advance of low area No. VI.

No. V—appeared over the Northwest on the 12th in rear of, and filling up the extensive trough left by, low area No. V. 13th, it followed in the track of the low area just mentioned, and by morning of the 14th was central over the Lake region. 15th and 16th, moved east and northeast over the North Atlantic States and Lower Canada, producing the lowest temperatures of the month at some stations, ranging from 24° at New Haven to 33° at Erie and Baltimore. 17th and 18th, was central over or north of the Gulf of St. Lawrence, the area extending southward over the Atlantic, (barometer at Bermuda 30.21, probably highest reading of month occurring on morning of this day.) 19th, disappeared in advance of low area No. VI.

No. VI.—Spread over California, the Western plateau and Rocky Mountain region on the 16th. 17th, highest pressure over the Western plateau or Rocky Mountain region, where it remained until the 20th, while an extensive depression, including within its area low pressures Nos. VI, VIII, IX and X, covered the eastern section of the country. 21st, moved southeastward over the Southwest.

No. VII—appeared over Washington Territory on the 22d to the westward of low area No. XI, and during the 23d extended over Montana. 24th, the highest pressure was transferred to the extreme Northwest; light snow prevailed from Montana to Minnesota and New Mexico, and on the morning of the 24th and 25th, the lowest temperatures of the month occurred over this region, ranging from 12° at Santa Fe to zero at Fort Garland, Col., and —15° at Summit, Rio Grande Co., and on summit of Pike's Peak. 25th and 26th, moved eastward over the Lake region to New England, separating low areas Nos. XI and XII. 27th, disappeared eastward over the Atlantic.

No. VIII—appeared in Washington Territory and Oregon on the 26th, and moved rapidly southeastward to Utah and Colorado. 27th, it extended over the Southwest, where the lowest temperatures of the month occurred, ranging from 20° at Fredericksburg to 37° at Indianola and Galveston; frosts were reported from Indianola to the Rio Grande valley. 28th and 29th it moved eastward over the Southern States, producing the lowest temperatures of the month, on morning of the 29th, along the Gulf coast: New Orleans, 41°; Fort Barrancas, 31°; Milton, Fla., 30°, and Key West, 63°.

No. IX—appeared over Washington Territory and Oregon during latter part of the 28th, at which time the pressure was also rising in the Northwest in rear of area No. VIII. 29th, an extensive area of high pressure stretched from the Pacific coast to the Lake region, while low area No. XIV was developing over New Mexico and northwestern Texas. 30th, low area No. XIV moved northeastward into the Mississippi valley, thus dividing the present area of high pressure, the eastern portion of which passed eastward over the Atlantic States, while the original centre remained over the Western plateau. From the 28th to the 30th the minimum temperatures of the month occurred at most stations from California to Utah, and ranged from 47° at San Francisco and 37° at Los Angeles to 9° at Winnemucca.

Areas of Low Barometer.—Of these, fourteen are described below, and the tracks of twelve of them are shown on chart No. I, from a study of which it will be seen that they agree, in general, with those of the same month of preceding years. While over the eastern section of the country their paths were southeastward, but, after reaching the Mississippi valley, changed toward the northeast. Four of them, Nos. VI, VIII, XII and XIV, either originated or commenced their northward trend south of the 35th parallel.

No. I.—The low pressure area No XIII of the October REVIEW continued during the 1st of the present month off the coast of Nova Scotia and Cape Breton.

No. II—is a continuation of area No. XIV, noticed in the October REVIEW. On the 1st it was probably central some distance north of the Upper Lake region. High winds prevailed on the Lakes, and a severe storm, with heavy sea, on Lakes Michigan and Huron, which resulted in the loss of several vessels and lives along the eastern shore of former and north portion of latter. Cautionary Signals ordered up on the Lower Lakes morning of October 30th were continued, and were ordered up on the Upper Lakes morning of November 1st. The following maximum winds were recorded: Grand Haven, 1 p. m., SW. 36 miles; Port Huron, 12:30 p. m., SW. 30; Cleveland, 1:25 p. m., SW. 30, and Buffalo, 9:26 a. m., SW. 36. The signals at Marquette and Escanaba were ordered late, and not considered justified, the highest velocity at Marquette occurred at 3 a. m., NE. 34. During the day the barometer gradient was quite steep from the Lake region to the Ohio valley, but the storm was unattended by precipitation within the limits of our stations. On the 2nd it passed down the St. Lawrence valley, followed by north to west winds and light rain or snow.

No. III.—During the 4th the pressure fell over the Canadian Maritime Provinces, with light rain or snow and generally northerly winds; at night heavy snow-falls occurred at St. John and Chatham, N. B.,

and at the Magdalen Islands, and on the 5th the centre of depression appeared to move northward over the Gulf of St. Lawrence. 6th, lowest pressure north of New Brunswick, with westerly gales and light snow at the mouth of the St. Lawrence. 7th, it appeared to move up the St. Lawrence valley and to spread southward over New England, attended by cloudy weather and snow. 8th and 9th, it remained over the Canadian Provinces, accompanied by cloudy weather and light rain, sleet or snow, and on the 10th moved off to the eastward.

No. IV.—While area No. V, described below, was probably central over Oregon a subsidiary centre of depression apparently formed in Montana. 5th, it moved southeastward to the Lower Missouri valley, preceded by diminishing pressure, increasing cloudiness, and, during latter part of day, light rain or snow over the Lake region. 6th, On the morning of this day an extensive barometric trough extended from the Lower Missouri valley to New England, and by night the centre of depression was apparently transferred to the Atlantic coast, where it joined area No. III just described. In anticipation of dangerous winds attending the preceding two areas Cautionary Signals were ordered up on the Upper Lakes morning of the 5th; on the Lower Lakes during latter part of day and morning of the 6th; and on the Atlantic coast from North Carolina to Maine on morning of the 6th. The Atlantic coast signals were changed to Cautionary Off-shore Signals at midnight of the 7th and morning of the 8th, and all signals were justified, except at Port Huron and Eastport. The following maximum velocities were recorded:—on the 6th, Duluth, 6:50 a. m., NE. 40; Marquette and Escanaba, 28; Milwaukee, 26; Sandusky, 8 p. m., NE. 32: on the 7th, Alpena, 25; Sandusky, 10 p. m., NW. 32; Cleveland, 8 p. m., NW. 35; Erie, 10 p. m., NW. 32; Buffalo, 1 and 3 p. m., SW. 36: on the 8th, Rochester, 3:45 a. m., and Oswego, 4:15 a. m., NW. 26, storm severe on lake and two schooners driven ashore; Cape May, 11:30 a. m., NW. 46; Barnegat, 1:45 p. m., NW. 36; Sandy Hook, 11:45 a. m., NW. 48; New York, 11:30 a. m., NW. 37; Boston, 3 p. m., NW. 32. These show the highest velocities to have occurred in rear of the storm-centre and in advance of high area No. IV. Vessels arriving at the North Atlantic ports generally reported westerly gales, high seas and rain-squalls from the 5th to the 11th west of the 62nd meridian and north of 40th parallel.

No. V—appeared on the Pacific coast on the 4th, and cloudy and rainy weather (snow on the mountains) prevailed from San Francisco northward to British Columbia. 5th and 6th, lowest pressure moved southward over the Western Plateau from interior of Oregon and Idaho to Nevada and Utah, accompanied by rain and snow, occasionally quite heavy, and which extended by night of the 6th to Arizona and New Mexico. During these days the pressure was generally below the normal west of the Mississippi, but commenced rising over the Northwest and Upper Lake region during latter part of the 6th, in advance of high area No. IV. 7th and 8th, the lowest pressure (0.10 to 0.20 in. below normal) remained over the Western Plateau, and the highest pressure moved southward into the Mississippi valley; the pressure rising during the 7th, but falling on the 8th at the Rocky Mountain stations. Heavy rain and snow-storms prevailed in Arizona, New Mexico and Colorado. 9th and 10th, storm-centre moved northeastward from Colorado to the Upper Mississippi valley, accompanied by cloudy and rainy weather. Heavy rains of short duration fell in Texas. At Summit, Rio Grande Co., Col., 11,300 feet above sea-level, seventeen inches of snow fell from the 6th to the 10th, the heaviest fall, eight inches, occurring on the 7th. 11th, was over the Lake region, where high winds, cloudy and rainy weather prevailed, and with partly cloudy weather and light rains thence to the East Gulf and Atlantic States. 12th and 13th, was over the St. Lawrence valley and Canadian maritime provinces, followed by brisk to high northwest winds. Cautionary Signals were ordered up morning of the 10th on the Upper Lakes; morning of the 11th on the Lower Lakes, and on the afternoon of same day along the Atlantic coast from North Carolina to New York, (changed to Cautionary Off-shore morning of 12th;) and morning of the 12th along the New England coast, (changed to Cautionary Off-shore afternoon of 13th.) They were all justified, except on Lake Superior and at Eastport, Me. Maximum velocity, on the 11th, Milwaukee, 3:50 p. m., NW. 27; 12th, Grand Haven, 10:30 p. m., NW. 45; Buffalo, 11:50 p. m., SW. 37; Cape May, 12:45 p. m., S. 32; Cape Lookout, 2 a. m., SW. 36; 13th, Sandusky, 5:30 a. m., NW. 44; Oswego, 10:15 p. m., NW. 28; Cape May, 3 p. m., NW. 35; Sandy Hook, 11 a. m., W. 46; New York, 12:45 p. m., NW. 36; Newport, 2:44 p. m., SW. 33; Thatcher's Island, 3:45 p. m., W. 37.

No. VI.—On the 13th, the pressure being above the normal throughout the Mississippi valley, Northwest and Lake region, increasing cloudiness prevailed from Texas to New Mexico, with easterly winds and light rains in former, and northerly winds and light snow in latter. 14th, the lowest pressure was off the coast of Texas; easterly winds and increasing cloudiness prevailed from the Gulf coast to the Lake region to the west of high area No. V, and rainy weather, with winds backing to north and west, in Texas. 15th, storm-centre moved northward to Missouri; severe thunder-storms and heavy rains occurred from eastern Texas to Mississippi and easterly winds, increasing cloudiness and rain, thence to the South Atlantic States and Ohio valley. Cautionary Signals were ordered up morning of the 14th at Indianola and Galveston, and although somewhat late, were justified by easterly winds of 27 and 26 miles, respectively; morning of the 15th. at Port Eads, New Orleans and Mobile, the first two of which were justified by a registered velocity of 25 miles, SE., at Port Eads. 16th and 17th, lowest pressure over the Ohio valley and Lower Lakes, and cloudy and rainy weather extended thence to the Atlantic States. Cautionary Signals were hoisted in the Lake region night of the 15th and morning of the 16th, but were not justified. During latter part of the 17th the minimum pressure was probably transferred to North Carolina and Virginia. 18th and 19th, centre moved northeastward off the Middle Atlantic, New England and Nova Scotia coasts, rapidly in-

creasing in energy and producing brisk to high northerly and easterly winds and heavy rains from Connecticut to Cape Breton. Cautionary Signals were ordered up; morning of the 16th, from Cape May to Sandy Hook; midnight of the 17th, from New York to Portland, and on the afternoon of the 18th at Eastport, were justified as follows: on th 18th, Cape May, 3:30 p. m., N. 27; Sandy Hook, 8 p. m., N. 30; New York, 5 p. m., NE., 31; Boston, 5:50 p. m., NE., 31; on the 19th, Thatcher's Island, 2:30 a. m., N., 44, and Eastport, 2:45 a. m., NE., 36.

No. VII—was probably central near Vancouver's Island, on the morning of the 14th, where stormy weather prevailed throughout the day, preceded by a southeast wind of 40 miles, (estimated) at Victoria; southeast gales and heavy rains continued over this region until the 18th, in consequence of the high-pressure area No. VI. to the southward. During the day the lowest pressure moved southeastward to interior of Oregon, preceded by high southerly winds at places, and heavy coast rains, extending to northern half of California. On the 15th, the pressure rose rapidly at the Pacific coast stations and over the western plateau, and fell at the Rocky Mountain stations and in the Northwest, and this area probably either joined the depression then existing in the Mississippi valley and described as No. VI, or by moving southward over Colorado helped to form area No. VII. On this day light rains and snow fell in Idaho, Nevada and Utah, but no precipitation was reported at the Rocky Mountain stations. At 11 p. m., the pressure at Santa Fe was 29.66 or 0.16 below normal.

No. VIII—appeared in the Rio Grande valley during the 16th, and may possibly be a continuation of area No. VII; at midnight, rising barometer, north to east winds, cloud and rain prevailed over Texas. 17th, storm-centre moved eastward over the Gulf of Mexico, followed by increasing pressure and rains in Texas. Cautionary Signals ordered up at Indianola and Galveston, morning of the 16th, were justified by a severe NE. gale accompanied by very heavy rains during early morning of the 17th; maximum velocity at Indianola, 2:30 a. m., NE., 46; Galveston, 5:40 a. m., NE., 40, and at Port Eads, morning of the 17th, justified at 11 p. m., by a northeast wind of 35 miles, (estimated.) 18th, centre moved northeastward, preceded by southeast to north winds, and rain from Florida to Louisiana; the "Carrie Nelson" reported a heavy blow in 25° 12′ N. and 88° 05′ W. 19th, moved eastward over northern Florida, and thence northeastward, producing heavy rains along the South Atlantic coast and severe NE. gales along the coast of North Carolina. 20th and 21st, passed northeastward, south of Nova Scotia and Cape Breton, followed by northerly winds and rain along the coast; on these days heavy rains and southwest to northwest winds prevailed at the Bermudas. Cautionary Signals were ordered up at midnight of the 18th, and morning of the 19th, from Jacksonville to Kittyhawk; midnight of the 19th from Cape Henry to Sandy Hook, and morning of the 20th from New York to Eastport, and were justified, except at Jacksonville and along the New England coast. Maximum velocites on the 19th, at Tybee Island, 5:20 p. m., NW., 37; Cape Lookout, 9:30 p. m., NE., 52; Hatteras, 10:30 p. m., NE., 44; Kittyhawk, 11:30 p. m., NE., 49. On the 20th, Barnegat, 8:15 a. m., NE., 26, and Sandy Hook, 5:00 a. m., E., 30. On the 20th, SE. gales were experienced in 31° 52′ N., 77° 12′ W.; 41° 51′ W., 63° 35′ W., and 43° 06′ N., 58° 43′ W.

No. IX—was probably central in Manitoba on the 17th. 18th, was north of Lake Superior. 19th and 20th, north of Lake Huron, with light rains extending to Lake Erie. Its track is not charted.

No. X—appeared in the Missouri valley on the 19th, and moved rapidly southeastward during the 20th, almost without precipitation. During latter part of 20th, and early morning of the 21st, its centre remained almost stationary over Illinois and Indiana, with increasing cloudiness and a general light rain from the Upper Lakes to the Lower Mississippi valley; during latter part of day its centre was transferred to Virginia and North Carolina, with diminishing pressure and heavier precipitation from Georgia to New York. Heavy rain, turning into snow, fell in the Monongahela valley, causing a sudden rise in the rivers of this region. 22d, the 7:35 a. m. reports showed the lowest pressure, (about 29.20, or 0.90 below normal,) to be central over Chesapeake Bay, preceded by easterly gales and heavy rains along the New Jersey coast. At noon the centre was over Deleware Bay—Cape May barometer, 28.95, or about 1.10 inch below normal—and at 4:35 p. m., was central between Baltimore and Philadelphia, the barometers at these stations reading 28.98, or 1.08 and 1.05 inch, respectively, below normal. During the day the winds decreased over the Middle States as the centre of pressure enlarged in area, but increasing easterly gales, with high tides, prevailed along the New England coast and valley of the St. Lawrence; during the night the gale was specially severe in latter section and much damage was done to shipping. On the summit of Mount Washington the wind continued from the east all day, with light snow, the highest registered velocity of the month, 129 miles per hour, occurring at 4:30 p. m. Heavy snows fell in the Alleghany Mountains, the observer at Helvetia, Randolph Co., W. Va., reporting from 21 to 36 inches at altitudes of 1,300 and 1,800 feet. High westerly winds, increasing to gales at places on the North Carolina coast. 23d, the lowest pressure moved northward over New England, accompanied by light winds and calms, and followed by brisk westerly winds and clearing weather. Cautionary signals were ordered up along the Atlantic coast from Smithville to New York, on the 21st, (changed to Cautionary Off-shore on the 22nd,) and from New Haven to Eastport on the morning of the 22nd, (changed to Cautionary Off-shore morning of the 23rd, and were all justified. Maximum velocities on the 21st:—at Smithville, 10:00 a. m., W., 26; Wilmington, 2:30 p. m., W., 35; on the 22nd, Cape Lookout, 1:30 p. m., W., 52; Kittyhawk, 6:50 p. m., W., 40; Philadelphia, 9:30 a. m., NE., 38; Barnegat, 1:00 a. m., E., 38; Sandy Hook, 6:50 a. m., E., 56; New London, 12:40 p. m., E., 48; Wood's Holl, 1:55 p. m., E., 40; Boston, 3:30 p. m., E., 48; Thatcher's Island, 3:15 p. m., ESE., 50; Portland, 1:45 p. m., NE., 36; and, on the 23rd, Eastport, 12:20 a. m., NE., 60, with very high tides; Baltimore, 9:18 a. m., NW., 30; Cape May, 7:45 a. m., W., 52. Cautionary signals were also ordered up in the Lake region, but were only justified

on the Lower Lakes. Maximum velocities on the 22nd:—Oswego and Rochester, 5:15 p. m., NE., 32 and 30; Cleveland, 5:15 p. m., NW., 42; Sandusky, 6:45 p. m., NW., 42; and, on the 23rd, at Erie, 10:15 a. m., NW., 34, lake very rough.

No. XI—was probably northeast of British Columbia at midnight of the 21st, extending southwestward over Oregon, where the pressure was 0.30 below normal, followed, on the morning of the 22nd, by rising pressure, westerly winds and light rains. 22nd, moved southeastward to the Missouri valley, preceded by southeast winds in the Northwest. 23rd, moved down the Missouri valley, unattended by precipitation, except light snow in rear of the centre as the winds changed to colder northerly; during the day the lowest pressures of the month occurred over the Southwest and thence to Colorado and New Mexico, in which region a secondary centre of depression formed, which will be considered as area No. XII. 24th, the present area moved eastward over the central Mississippi and Ohio valleys, followed by northerly winds and light rains. 25th, moved from the Lower Lake region over New England, with light, but increasing, precipitation. 26th, passed south of Nova Scotia, and heavy rain prevailed for a short time at Halifax and Sydney.

No. XII.—Formed during the 23rd over the high lands in northwestern Texas and New Mexico, where high temperature prevailed during the afternoon. 24th, moved southeastward over Texas, followed by cold northerly winds, with snow in New Mexico and rain in western Texas. 25th, was off the coast of Texas and Louisiana, followed by brisk to high northerly winds, rain or snow in former, and preceded by easterly winds and heavy rain at New Orleans. 26th, moved northward, with southerly winds and heavy rains on the East Gulf coast, and generally rainy weather thence to Tennessee and Virginia. 27th, moved northward to the Lower Lakes, with heavy rains, thence to the Atlantic coast, and heavy snows from Arkansas to Michigan. 28th, passed down the St. Lawrence valley, with heavy rains, thence to the coast of New England and Nova Scotia. Cautionary Signals ordered up at Indianola and Galveston were justified on the 25th: Indianola, 10 a. m., N. 43, and Galveston, 7:45 p. m., NW. 32; on the Atlantic coast from Smithville to Sandy Hook on the 26th, (changed to Cautionary Off-shore on the 27th;) from New York to Eastport on the 27th, (changed to Cautionary Off-shore on the 28th;) and in the Lake region on the afternoon of the 27th were justified except at the stations in northern Michigan. Maximum velocities: on the 27th, at Wilmington, 1:45 p. m., SW. 31; Cape Hatteras, 4:00 p. m., S. 40; Kittyhawk, 4:35 p. m., S. and SW. 44; Barnegat, 8:40 p. m., SE. 40; Sandy Hook, 5:35 p. m., E. 47; New London, 10:20 p. m., SE. 45; Thatcher's Island, 11:00 p. m., SE. 34; Duluth, 11:00 p. m., NW. 34. On the 28th, Cape Lookout, 4:30 a. m., W. 40; Cape May, 3.45 p. m., W. 46; Newport, 10:40 p. m., NW. 32; Wood's Holl, 2:05 a. m., SE. 34; Thatcher's Island, 1:00 a. m., NW. 35; Eastport, 8:25 a. m., SE. 38; Erie, 6:30 a. m., W. 32; Cleveland, 4:10 a. m., NW. 36; Sandusky, 2:35 a. m., W. 37.

No. XIII—was probably north of Montana on the 25th, and passed eastward, over Manitoba, on the 26th, followed by high north winds and light snows in Dakota and Minnesota.

No. XIV.—During the 28th the pressure fell below the normal over the Western Plateau, and on the 29th in New Mexico, while high-pressure area No. IX was over Montana; light snows fell during these days from Idaho to Colorado and New Nexico; five inches of snow was reported at Summit, Rio Grande county, Colorado. During latter part of the 29th the lowest pressure was central over the high lands of western Texas. 30th, moved eastward to Arkansas, preceded by a heavy NE. snow-storm in the Lower Missouri valley, and followed by brisk to high northerly winds in Texas. Cautionary Off-shore Signals were ordered at Indianola and Galveston. Maximum velocity at Indianola, NW. 32. This area afterwards developed into quite a severe storm, and will be considered in the December REVIEW.

INTERNATIONAL METEOROLOGY.

On chart No. IV are shown the partial tracks of hurricanes occurring over the Oceans as follows: *Atlantic.*—No. I. as given in the September REVIEW; No. II, September 14th to 17th; No. III, September 24th to October 3rd, and No. IV, September 29th to October 8th, that were treated of in the October REVIEW as one storm, but Mr. Jahncke, of St. Thomas, considered them as two, whose paths crossed each other. No. V, October 9th to 20th, probably reached the British Isles. No. VI, October 14th to 19th, the track of which is nearly identical with that of No. V, but about five days later. No. VII, October 21st to 29rd, was treated of in the October REVIEW. *Pacific.*—No. I, September 12th; No. II, September 15th to 19th; No. III, September 19th; No. IV, October 7th to 9th; No. VI, October 17th to 19th. Additional reports of storms are to hand. *South Atlantic Ocean.*—September 8th, 31° 19′ S., 31° 00′ E; September 25th to October 1, storm lasting six days off the coast of Brazil; October 3rd, heavy at Caraeos, Venezuela.

TEMPERATURE OF THE AIR.

The isothermal lines on chart No. II illustrate the general distribution of the temperature of the air for the month. The mean temperature for Punta Rassa should be 69°.6 instead of 74°, as given on the chart. By reference to the table on the left-side of the chart, it will be seen that the temperature has been considerably above the normal over the interior of the continent, the largest deviation from the normal (+13°.7) occurring in the Upper Missouri valley. Along the Pacific, Gulf and South Atlantic coasts it has ranged about, or slightly above, normal, and in the Middle States and New England about 3° above.

Minimum and Maximum Temperatures, respectively:—*Maine*—Mechanics' Falls, 15° and 50°; Portland, 22°, 56°; Eastport, 17°, 54. *New Hampshire*—Dunbarton, 13°, 52°; Mt. Washington, —10°, 37°. *Vermont*

—Woodstock, 12°, 54°; Burlington, 21°, 52°. *Massachusetts*—Westborough, 17°, 60°; Boston, 22°, 61°; Springfield, 22°, 66°. *Rhode Island*—Newport, 26°, 57°. *Connecticut*—Colebrook, 17°, 56°; New Haven, 24°, 61° *New York*—Schroon Lake, 10°, 56°; Nile, 13°, 54°; Plattsburg Bks., 18°, 48°; New York City, 28°, 59°; Buffalo. 24°, 54°. *New Jersey*—Linden, 18°, 54°; Acto, 26°, 64°; Trenton, 28°, 60°. *Pennsylvania*—Franklin, 16°, 52°; Brownsville, 26°, 68°; Philadelphia, 36°, 64°; Pittsburgh, 21°, 58°. *Delaware*—Dover, 31°; 61°. *Maryland*—Woodstock, 21°. 69°; St. Inigoes, 40°, 75°; Baltimore, 33°; 69°. *District of Columbia*—Washington, 27°, 56°. *Virginia*—Snowville, 22°, 68°; Johnsontown, 35°, 72°; Lynchburg, 30°, 68°. *West Virginia*—Morgantown, 25°; 59°. *North Carolina*—Franklin, 20°, 68°. Weldon, 30°, 76°. *South Carolina*—Aiken, 33°, 74°; Charleston, 37°, 75°. *Georgia*—Gainesville, 30°, 73°; McPherson Bks., 29°, 74°; Augusta, 33°: 77°. *Florida*—Camp Barrancas, 31°, 86°; Key West, 63°, 85°; Milton, 30°, 76°. *Alabama*—Mobile, 36°, 81°; Montgomery, 33°, 77°. *Mississippi*—Fayette, 31°, 78°. *Louisiana*—Point Pleasant, 36°, 79°; New Orleans, 41°, 76°; Shreveport, 34°, 81°. *Texas*—Fort Davis, 17°, 76°; Fredericksburg, 20°, 78°; Uvalde, 28°, 86°. *Ohio*—Bellefontaine, 19°, 63°; Columbus, 24°, 63°; Toledo, 26°, 60°. *Kentucky*—Danville, 21°; 69°; Louisville, 30°, 72°; Bowling Green, 26° 74°. *Tennessee*—Clarksville, 23°, 71°; Nashville, 28°, 71°; Knoxville, 54°, 69°. *Arkansas*—Mt. Ida, 21°, 80°; Judsonia, 33°, 74°. *Michigan*—Litchfield, 17°, 54°; Marquette. 18°, 59°; Detroit, 14°, 53°. *Indiana*—Spiceland, 19°, 64°; St. Meinrad, 32°, 72°; Indianapolis, 25°, 65. *Illinois*—Mt. Sterling, 13°, 69°; Anna, 30°, 75°; Cairo, 30°, 71°; Chicago, 31°, 57°. *Missouri*—Wet Glaze, 16°, 85°; Pierce City, 19°, 81°. *Kansas*—Fort Hays, 6°, 76°; Dodge City, 13°, 74°; Leavenworth, 25°, 71°; Independence, 22°, 83°. *Wisconsin*—Neillsville, 8°, 60°; Embarras, 16°, 56°; Madison, 24°, 58°. *Iowa*—Vail, 12°, 70°; Logan, 14°, 72°; Des Moines, 21°, 69°. *Nebraska*—Sidney Bks., 7°, 81°; North Platte, 17°, 75°; Omaha, 18°, 71°. *Indian Territory*—Fort Sill; 17°, 81°; Fort Gibson, 22°, 78°. *Minnesota*—Breckenridge, 3°, 59°; St. Anthony, 10°, 63°; Duluth, 13°, 53°. *Dakota*—Pembina, 2°, 51°; Yankton, 15°, 73°; Bismarck, 19°, 58°. *Colorado*—Fort Garland, 0, 60°; Pike's Peak, —15°, 33°; Denver 11°, 73°; Colorado Springs, 5°, 66°. *Wyoming Territory*—Fort Fetterman, 1°, 72°; Cheyenne, 2°, 67°; Fort Fred. Steele, 3°, 67°. *Utah*—Salt Lake City, 22°, 68°. *Nevada*—Winnemucca, 9°, 66°; Pioche, 17°, 67°. *California*—Visalia, 29°, 76°; Sacramento, 34°, 72°; San Francisco, 47°, 68°; Los Angeles, 37°, 81°; Red Bluff, 34°, 77°. *New Mexico*—Santa Fe, 12°, 77°, Fort Union, 2°, 72°. *Idaho*—Boise City, 18°, 70°. *Montana*—Virginia City, 11°, 59°.

Ranges of Temperatures.—The *monthly ranges* will appear from an examination of the maxima and minima just given. Greatest *daily ranges* vary in New England, from 19° at Portland to 29° at New Haven; Mount Washington, 23°; Middle Atlantic States, 20° at Albany to 31° at Lynchburg; South Atlantic States, 20° at Cape Lookout and Charleston to 32° at Wilmington; Gulf States, 12° at Key West to 34° at Corsicana, and 35° at St. Marks; Ohio valley and Tennessee, 22° at Louisville to 35° at Knoxville; Lower Lakes, 16° at Erie to 27° at Toledo; Upper Lakes, 20° at Port Huron to 30° at Marquette; Upper Mississippi valley, 22° at La Crosse to 33° at St. Louis; Missouri valley, 30° at Omaha to 44° at Yankton; Eastern slope of Rocky Mountains, 35° at Deadwood, Dak., and 31° at Dennison, Tex., to 49° at North Platte and Fort Stockton; Rocky Mountain stations, 26° at Virginia City to 48° at Fort Craig; 22° on summit of Pike's Peak; Western Plateau, 28° at Pioche to 43° at Winnemucca; California, 15° at San Francisco to 56° at Campo.

Frost has been quite general over the northern sections of the country, and the following items will show its occurrence in some of the southern states: Houston, Fla., injuring vegetation, 1st; Quitman, Ga., first frost, 1st; in southern Texas and lower Rio Grand valley, the first frost of season occurred on the 27th; at Milton, Fla., first frost, 28th.

Ice.—Santa Fe, N. M., 17th, ½ inch; 25th, creeks frozen; Albuquerque, N. M., 18th, 24th, (25th and 26th, ½ in.,) 27th to 30th; Denison, Tex., 27th; Mobile, Ala., 1st, 2nd; Dubuque, Ia., 26th; Cleveland, Ohio, 24th; Cincinnati, 1st, 29th; Louisville, Ky., 1st, 29th; Nashville, 29th; Smithville and Wilmington, N. C., 1st; Atlanta, Ga., 1st; Lynchburg, 1st; Atlantic City, N. J., 5th; Baltimore, 4th; Philadelphia, 5th, 9th; Ft. Whipple, Va., 30th; Newport, R. I., 4th, 5th; New London, 4th, 15th, 16th, 27th; Boston, 4th; Forsyth, Ga., 1st; Thomasville, Ga., 29th; Creswell, Kan., 1st to 3rd; Independence, Kan., 3rd, 12th, 13th, 25th to 29th; Pt. Pleasant, La., 28th; Gardiner, Me., 7th; Somerset, Mass., 4th; Springfield, Mass., 2nd, 3rd, $\frac{1}{10}$, 4th, ¼ in., 5th, ¾ in.; Rowe, Mass., 28th; Oregon, Mo., 8th, 13th, 25th to 29th; Auburn, N. H., 4th, 5th; Freehold, N. J., 9th, ¼ in., 14th, 15th, ¼ in.; Sacramento, Cal., 28th to 30th; Boise City, Idaho, 7th, 10th to 13th, 23rd to 29th; Princeton, Cal., 1st; Catawissa, Pa., 1st, 2nd, 5th, 6th, 8th, 9th, 14th to 16th, 26th, 29th, 30th; West Charlotte, Vt., 4th, 5th; Dover Mines, Va., 4th, 5th, 8th, 10th, 15th, 29th, 30th; Wytheville, Va., 14th, ice on pond, 24th, thin ice all over pond.

Ground Frozen as follows: North Volney, N. Y., 5th; Starkey, N. Y., 9th; Fayetteville, N. C., 1st; Catawissa, Pa., 2nd, 5th, 9th, 15th, 30th; Fallsington, Pa., 2nd, 4th, 5th, 9th; Ringtown, Pa., 4th, one inch; Woodstock, Vt., 4th to 9th, three inches; West Charlotte, Vt., 4th, 5th, 14th to 16th; Broad Oak, Va., 4th, 30th; Wautoma, Wis., 30th, two inches.

PRECIPITATION.

On chart No. III is illustrated the general distribution of the precipitation of rain and snow for the month. On the left side is a table giving the average precipitation for November, which shows a decided excess on the East Gulf coast, over New England and in the St. Lawrence valley. The greatest deficiencies occur in the Pacific coast States, and from the Lower Missouri valley to the Upper Lakes.

Special Heavy Rains.—15th, Fort Barrancas, Fla., 3.29 in.; 17th, Auburn, N. H.; 3.25 in.; Indianola, Tex., 3.16 in.; 17th and 18th, Contoocookville, N. H., 2.75 in.; New Orleans, 2.38 in.; New Bedford, Mass.,

3.74 in.; 18th, Boston, 3.09 in.; Newport, R. I., 2.97 in.; Auburn, N. H., 2.49 in.; 18th and 19th, Thatcher's Island, Mass., 5.75 in.; 17th to 19th, Westborough, Mass.; 3.22 in.; Amherst, Mass., 2.44 in.; Dunbarton, N. H., 3.54 in.; 19th, Lawrence, Mass, 2.16 in.; Fort Barrancas, Fla., 2.15 in.; 18th to 21st, Milton, Mass., 3.75 in.; 18th to 22d, Mendon, Mass., 5.00 in.; 22d, Boston, 2.18 in.; Antrim, N. H., 2.40 in.; Sandy Hook, N. J., 2.75 in.; Auburn, N. H., 4.00 in.; 25th, New Orleans, 2.13 in.; 25th and 26th, Knoxville, 2.98 in.; 26th, Mobile, Ala., 3.32 in.; St. Marks, 2.70 in.; Highlands, N. C., 4.00 in.; Fort Barrancas, Fla., 10.39 in.; 27th, Fayetteville, N. C., 4.25 in.; Sandy Hook, N. J., 2.00 in.; White Plains, N. Y., 3.90 in.

Largest Monthly Rain-falls.—Fort Barrancas, Fla., 17.79 inches; Olympia, Wash. Ty., 11.09 in.; Auburn, N. H., 9.82 in.; White Plains, N. Y., 9.80 in.; Boston, 8.94 in.; Thatcher's Island, Mass., 9.30; Dunbarton, N. H., 8.63 in.; Newport, R. I., 7.99 in.; New Orleans, La., 7.78 in.; Antrim, N. H., 7.55 in.; Galveston, Tex., 7.31 in.; Highland, N. C., 7.00 in.; Sandy Hook, 6.96 in.; St. Marks, Fla., 6.89 in.; New Ulm, Tex., 6.68 in.; Clinton, Mass., 6.75 in.

Smallest Monthly Rainfalls.—Los Angeles and San Diego, Cal., none; Cheyenne, Wy. Ty., Fort Lincoln, Dak., and Fort Hartsuff, Neb., trace; Yuma, Ariz., 0.02 inches; Sidney Bks., Neb., 0.07 in.; Visalia, Cal., Fort Fred Steele, Wy. Ty., Hennepin, Ill., and Vail, Ia., 0.10 in.; Wickenburg, Ariz., 0.12 in.; Winnemucca, Nev., 016 in.; Fort Craig, N. M., 0.18 in.; Fort Gibson, Ind. Ty., 0.21 in.; Camp Stockton, Tex., 0.22 in.; Salinas City, Cal., 0.20 in.; Fort Pembina, Dak., 0.24 in.; Pilot, Tex., 0.25 in., Phœnix, Ariz., and Afton, Ia., 0.30 in.; Virginia City, Mont., 0.31 in.; Point San Jose, Cal., 0.32 in.; Camp McDermit, Nev., 0.35 in.; Camp Verde, Ariz., 0 36 in.

Drought.—Independence, Kan., during the entire month drought very severe, wheat dying; many wells and springs exhausted, and farmers obliged to transport water a considerable distance for domestic purposes. Lebanon, Mo., 28th, very dry, causing forest fires; creeks and ponds nearly dried up; water very scarce for stock; fall wheat injured to some extent. Melissa, Tex., 30th, water for stock very scarce, but little rain has fallen since September.

Hail.—Willett's Point, N. Y., 8th; Gainesville, Ga., 10th and 11th; Anna, Ill., 27th; New Harmony, Ind., 27th; West Waterville, Me., 18th and 30th; Gardiner, Me., 25th; Mechanics' Falls, Me., 18th; New Market, Md., 6th; Springfield, Mass., 22nd; Wappinger's Falls, N. Y., 13th; Flushing, N. Y., 6th; Cape Vincent, N. Y., 30th; Clarksville, Tenn., 15th; Woodstock, Vt., 18th, 22nd, 25th and 27th; Manitowoc, Wis., 6th; Albuquerque, N. M., 7th and 13th; Pembina, Dak., 21st; Denison, Tex., 25th; Burlington, Vt., 20th; Escanaba, Mich., 5th; Grand Haven, Mich., 23rd; Fort Whipple, Va., 26th; Laredo, Tex., 17th and 25th.

Rainy Days.—The number of days on which rain or snow has fallen varies as follows: New England, 10 to 22; Middle States, 6 to 16; South Atlantic States, 5 to 10; Gulf States, 6 to 10; Ohio valley and Tennessee, 8 to 14; Lower Lake region, 10 to 22; Upper Lake region 10 to 16; Upper Mississippi valley, 4 to 11; Lower Missouri valley, 3 to 7; Eastern Slope, 1 to 7; Rocky Mountains, 5 to 13; Western Plateau, 1 to 8; Pacific coast, 1 to 4.

Cloudy Days.—For New England, the number varies from 9 to 23; Middle States, 5 to 15; South Atlantic States, 4 to 9; Gulf States, 4 to 9; Ohio valley and Tennessee, 8 to 17; Lower Lake region, 10 to 24; Upper Lake region, 7 to 19; Upper Mississippi valley, 4 to 14; Lower Missouri valley, 3 to 8; Eastern Slope, 2 to 14; Rocky Mountains, 2 to 10; Western Plateau, 3 to 6; Pacific coast, 1 to 4.

Snow.—On the 1st, N. Y., Conn., Ia., Vt. 2nd, Mich., N. Y. 3rd. N. H. N. Y. 4th, N. H., Me., Mass., N. Y., Vt. 5th, N. Y., N. H., Me., Vt., Nev. 6th, Wis., Minn., N. Y., Mich., R. I., N. H., Mass., Conn. N. J., Nev. 7th, Col., N. Y., N. J., N. H., Me., Mass., Mich., Vt., N. M., Cal. 8th N. M., N. Y., N. H., Conn., Me., Mass., N. J., Vt. 9th, N. M., Col., Me., N. Y., Vt., Mont. 10th, Col., Neb., Me., N. H., N. Y., Utah. 11th, Vt., N. M. 12th, Mich., N. H., N. Y., Wis. 13th, N. Col., Mich., N. H., N. Y., Vt. 14th, Col., Mass., N. Y. 15th, Col., N. H., N. Y. Wy. T., Nev., Mont. 16th, Col., Tex., Utah. 17th, N. H. 18th, N. H., Wy. T. 19th, N. H., Mass. 20th, Col., N. H., Va., Neb. 21st, Mich., Minn., Ia., Tenn., Va., Wis. 22nd, Minn., N. H., Mich., Va., Wis., Mont. 23rd, Col., Dak., N. Y., W. Va., N. H., Wis., Mont., Minn., Utah, Wy. T. 24th, N. M., Col., Dak., Ia., Minn., Wis., Mich., N. H., Neb., Wy. T. 25th, N. M., Col., Ia., Wis., Mich., Minn., N. Y., N. H., Me., Tex., Vt. 26th, Dak., Ia., Minn., Va., N. H., N. Y., Vt., Tex., La. 27th, Dak., Wis., Mich., Ohio, Ky., Ill., Ind., Tenn. 28th, Mich., Ohio, N. H., Ind., N. Y., Neb., Mont. 29th, N. M., Utah, Col., Mich., M. H., Ind., N. Y., Idaho. 30th, Col., Dak., Ia., N. H., N. Y., Kan., Mo., Vt. At the end of the month the depth of snow on ground was reported as follows: Summit, Col., 18 in.; Milford, Ind., 2 in.; Holton, Kan., 2½ in.; Arkansas City, Kan., 1 in.; Creswell, Kan., 7 in.; Topeka, Kan., 7½ in.; Litchfield, Mich., 4 in.; Oregon, Mo., 5 in.; Kansas City, 2¾ in.; Salt Lake City, ¼ to ½ inch in sheltered places; Virginia City, Montana, 2 in.; Denver, Col., 1 in.; Santa Fé, N. M., trace; Pike's Peak, 2 in.; Deadwood, Dak., trace; Leavenworth, Kan., 4 in.; Breckenridge, ½ in.; Pembina, Dak., ¼ in.; La Crosse, trace; Keokúk, 1½ in.; Duluth, ½ in.; Madison, 1 in.; Indianapolis, trace; Boise City, Idaho, trace; Mt. Washington, 12 in.

RELATIVE HUMIDITY.

The average per centage of relative humidity for the month ranges as follows: New England, 68 to 77; Middle Atlantic States, 60 to 76; South Atlantic States, 64 to 77; East Gulf States, 68 to 79; West Gulf States, 61 to 77; Lower Lakes, 68 to 80; Upper Lakes, 70 to 78; Ohio valley and Tennessee, 62 to 74; Upper Mississippi valley, 63 to 75; Lower Missouri valley, 60 to 76; Red River of the North valley, 79 to 83; Eastern Slope, 59 to 69; Western Plateau, 43 to 62; California, 58 to 75. *High stations* report the following, not corrected for altitude: Mt. Washington, 93; Virginia City, 54; Cheyenne, 55; Denver, 42; Santa Fe, 53; Colorado Springs, 52.

WINDS.

The prevailing winds at the Signal Service Stations are shown by arrows on chart No. II, by an examination of which it will be seen that they have been very generally north or westerly. In southern Texas, Minnesota, Montana, Nevada, Idaho, Oregon and Washington Territory they have been southeasterly.

Total Movements of the Air.—The following are the *largest* monthly movements recorded at the Signal Service Stations, viz: Sandy Hook, 13,949 miles; Cape May, 13,509; Pikes Peak, 12,439; Cape Lookout, 12,134; Thatcher's Island, 11,954; Kittyhawk, 11,004; Portsmouth, N. C., 10,165; Indianola, 9,809; Sandusky, 9,704; Barnegat, 9,659: New York, 9,049; Wood's Holl, 8,982; Newport, 8,724; Boston, 8,619. The *smallest* are: Visalia, Cal., 1,491 miles; Deakwood, Dak., 1,754; Nashville, 1,913; Virginia City, 2,178; Shreveport, 2,235; Lynchburg, 2,583; Uvalde, Tex., 2,630; Knoxville, 2,674; Indianapolis, 2,869; Dubuque, 2,876; Boise City, Idaho, 3,041; Augusta, Ga., 3,122; Sacramento, Cal., 3,140; Salt Lake City, 3,148; Los Angeles, Cal., 3,293.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily weather Indications, with the telegrapic reports for the succeeding twenty-four hours, show the general percentage of omissions to be 0.5 per cent., and of verifications to be 90.7 per cent. The percentage of verifications for the four elements have been: weather, 95.1; wind, 88.1; temperature, 91.7; barometer, 87.8. The percentage of verifications by geographical districts have been: New England, 89.1; Middle States, 90.8; South Atlantic States, 91.3; East Gulf States, 88.2; West Gulf States, 90.4; Lower Lake region, 91.0; Upper Lake region, 89.7; Tennessee and Ohio valley, 92.4; Upper Mississippi valley, 92.4; Lower Missouri valley, 91.5. Of the 3,588 predictions that have been made, 82, or 2.3 per cent., are considered to have entirely failed; 90, or 2.5 per cent., were one-fourth verified; 326, or 9.1 per cent., were one-half verified; 85, or 2.4 per cent., were three-fourths verified; 2,999, or 83.8 per cent., were fully verified, so far as can be judged from the tri-daily weather maps.

Cautionary Signals.—During the month 260 Cautionary Signals were displayed; 202 or 77.7 per cent., were justified by subsequent hourly velocities of 25 miles or over at or within 100 miles of the station.

Cautionary Off-shore Signals.—twenty-nine signals, not included in the above, were ordered up as Cautionary Off-shore Signals; 26 or 89.7 per cent. of these were justified, both as to velocity and direction. seventy-six Cautionary Signals were changed to Cautionary Off-shore Signals, and as to direction were all justified; as to velocity they are considered with the Cautionary. Thirty nine cases were reported, generally from scattered stations, of winds of 25 miles or over, when signals were not ordered.

NAVIGATION.

In the table on the right hand of chart No. III are given the highest and lowest readings on the Signal Service river gauges, during the month, with dates of same, from which it will be seen that the Mississippi and its western tributaries have continued low throughout the month. In consequence of the heavy rains during latter portion of month, (mostly due to storm-areas Nos. X and XII) rapid rises occurred in the head waters of the Ohio and tributaries, and in the Savannah river. *Ice in rivers.—Missouri*—Lower Brule Agency, Dak., 8th, last boat of season passed down, 30th, river covered with floating ice. Plattsmouth, 26th to 30th, soft ice floating in river. *Mississippi*—La Crosse, 29th and 30th, ice running from Black river in small pieces.

High Tides.—Tybee Island, Ga., 19th; Flushing, N. Y., 22nd, (3½ feet above ordinary high tide-mark;) on the 23rd, Eastport, Me., running over some of the wharves; Portland, Me., highest known for years, even with the wharves.

Low Tides.—Indianola, Tex., 22nd to 30th; Tybee Island, Ga., 22nd and 23rd, long continued off-shore winds have caused very low water in the Savannah river, affecting navigation somewhat, and causing the lowest tide known for many years.

ATMOSPHERIC ELECTRICITY.

Thunder-storms.—3d, Tex. 4th, N. M. 5th, N. M., Wis., Mich. 6th, Iowa, Ill., Kan., Mo. 7th, N. M., Tenn., Ill., Ind., Ky., Tex. 9th, Ind. Ty. 10th, Tex. 11th, N. C., Ill., Ky., Tex. 12th, N. C., Va. 14th, Ill., Tex. 15th, Ala., Tex., Miss. 16th, Tex. 17th, Tex. 18th, Ala., Miss. 19th, Fla., N. C. 20th, La., Va. 21st, N. C., Va. 22d, N. J., Va. 23d, Mass., Minn. 24th, Tex. 25th, La., Tex. 26th, Fla.

Auroras.—Pembina, Dak., 18th; Dubuque, Ia., 16th; Escanaba, Mich., 30th; Boston, 30th; Cresco and Nova Springs, Ia., 30th; Cornish and Mechanics Falls, Me., 14th; Gardiner, Me., 6th, 20th, 30th; Waltham, Mass, 14th. 30th; Cambridge, Mass, 14th; St. Anthony, Minn., 29th; Oregon, Mo., 14th; Contoocookville, N. H., 14th; Starkey, N. Y., 7th; Cape Vincent, N. Y., 14th; Franklin, Pa., 12th; Woodstock, Vt., 40th; Beloit, Wis., 21st.

Telegraphic Communication Interfered with by Atmospheric Electricity.—Santa Fe, N. M., 7th, 8th, 9th; Albuquerque, N. M., 13th; Ft. Sill, Ind., Ty., 9th, line ceased working.

OPTICAL PHENOMENA.

Solar Halos.—1st, Conn., Cal.; 2d, Cal.; 4th, Fla., Tex.; 5th, Ia., Mo., O., La., Miss.; 7th, Tex., Fla,, Conn., Tex.; 8th, Dak., Mass., Tex.: 9th, Dak., Conn., Miss., O., La.; 10th, O., Ind.; 11th, Dak., Conn., Ill., Miss.; 12th, N. M., Conn., Cal.; 13th, N. J., Tex.; 14th, Iowa, Mo., O., Ill., Ind., Me., N. J.; 15th, Ia., O., R. I., Conn., Ill., Mass., Mich., N. H., N. J., N. Y., V.; 16th, Conn., N. Y. 17th, Wis. 18th, Ia., Minn.,

19th, Ind. 20th, O. 21st, N. Y. 24th, N. C., Kan., O. 25th, Conn. 26th, Conn., Mich., N. Y. 27th. Conn., Ill., Me., N. H. 28th, Ia., Tex. 29th, Ia., O., Ill., La., Mo. 30th, N. C., Conn., Ill., La., Mich., Miss., N. J., O., Tenn., Tex.

Lunar Halos.—1st, N. M., Neb., Ia., Minn. 2nd, Ia., Wis., Minn., Ill., Conn., Mo., Cal., Neb., Tex., La 3rd, N. M., Utah, Nebr., Dak., Tex., Fla., Ia., Wis., Minn., O., R. I., Conn., Me., Mass., N. J., N. Y. Cal., Nev., Idaho., La. 4th, Utah, Nebr., Ind. Ty., Wis., Miss., Mo., Nev., Minn. 5th, Ia., Minn., Ill., Ga., Conn., N. Y., Ala., Mass. Mo., N. J., Pa., Idaho, Tex., La. 6th, Kan., Ala., Ill., N. H., Mo., Nebr., N, Y., Tex. 7th, Tex., Fla., Wis., Ill., Tenn., Mass., N. J., La., Minn. 8th Dak., Tex., Wis., Minn, Ill., R. I., Me., Mass., N. H., N. J., Mich., La. 9th, Tex., Ala., Ia., Minn., Wis., O., Ill., R. I., Conn., Mass., Me., La., Miss., Mo., N. J., Pa. 10th, Tex., N. Y., N. C., N. J., Md., Pa., Va., Conn., Mass., Mich., Mo., O., La. 11th, Dak., Tex., Minn., Wis., N. Y., S. C. Ill., Miss. 12th, N. M., Tex., Ohio, Conn., Mass., Mo., N. J., N. Y., Pa., Cal., Minn. 13th, Ind. Ter., Neb., Ia., Wis., Mo., Neb., N. J., Kan., Tex., La. 14th, Dak., Ia., Mich., Ohio, Va., N. J., Conn., Ill., Kan., Tex. 15th, Va., Me., O., Wis., Cal., Tex. 17th, Dax., Tex. 18th, Neb., Tex. 19th, Ind., Tex., La. 20th, Wis. 21st, Me. 28th, Wis., Tex., La., Minn. 29th, Dak., Tex., Ia., Wis., Ill., Conn., Neb., O., Tenn., Cal., Nev., Minn. 30th, Ia., Mich., Ohio, W. Va., Ind., N. C., Pa., Va., Ill., Ky., Md., Miss., N. J., Va., Wis., Cal., Idaho, Tex., La.

Mirage.—Pembina, Dak., 3rd; New London, 4th, 7th, 8th, 15th, 19th, 27th, 29th; New Bedford, Mass., 10th; Olivet, Dak., 26th.

MISCELLANEOUS PHENOMENA.

Botanical.—*Florida*—Houston, 30th, month has been very pleasant and favorable to vegetation, most vines are still growing; sugar care not yet injured; the manufacture of sugar has continued throughout the month. Milton, since the 15th all winter gardens are doing well. *Iowa*—Tabor, 30th, weather remarkably favorable during the month for harvesting fall crops; corn two-thirds of a crop, but of very good quality and mostly harvested in fine condition. Vail, 30th, farmers still plowing. *Maryland*—Sandy Spring, 30th, clover in bloom second time. *Massachusetts*—Mendon, 30th, grass still green. Somerset, 30th, dandelions and arnica in bloom second time. *Missouri*—Oregon, 25th, farmers still plowing. *Mississippi*—Fayette, 30th, month very favorable for cotton picking; crop all gathered but very light; corn, potatoes and sugar cane very good; hardly a killing frost, some tender plants still alive; sage and morning glories in bloom second time. Brookhaven, 5th, forest leaves falling; witch-hazel, chinese pinks, roses and snap-dragons in bloom second time. *Texas*—Melissa, 14th, early sown fall wheat looking very green, some farmers still sowing; 30th, harvesting of corn and cotton about finished, average yield per acre of corn, about 50 bushels, of cotton about 500 lbs. Clarksville, 30th, very little wheat sown, ground too dry to work, cotton crop nearly all gathered, quality very good but quantity much below expectations. *Pennsylvania*—Chambersburg, 30th, pansies in bloom in the open air. *Virginia*—Broad Oak, 30th, forest leaves all fallen, fall wheat looks well. *Nebraska*—Genoa, farmers plowing during entire month. *New York*—Wappinger's Falls, 21st, farmers still plowing. Palermo, 17th, leaves falling from fruit trees; 10th, grass still green. Flushing, 24th, dandelions in bloom second time. *North Carolina*—Fayettesville, 14th, cherry trees in bloom second time; 30th, fall roses, chrysanthemums and violets in bloom second time, corn crop good, cotton fair, potatoes excellent, fruit average, wheat acreage larger than usual and looks fine. Weldon, 30th, corn crop good, cotton crop small. *Ohio*—Jacksonburg, 26th, wheat and barley luxuriant; 1st to 18th, foliage falling. Ringgold, 30th, wheat and grass still growing.

Insects.—*Bees.*—Monticello, Ia., 12th, out in open air. *Moths.*—Oregon, Mo., 5th. *Locusts.*—Denver, no locusts seen during month, and none this year up to date. Fort Sill, Ind. Ty., 1st, diminishing in numbers; 2nd, a few observed going S.; 3rd, gradually decreasing; 12th, almost entirely disappeared. *Crickets.*—Melissa, Tex., 10th. *Native Grasshoppers.*—Melissa, Tex., 29th. *Worms.*—Flushing, N. Y., 28th, appeared on surface of ground. *Small Insects.*—Palermo, N. Y., 16th, myriads flying in the air. *Butterflies.*—Oregon, Mo., 5th. *Katydids.*—Brookhaven, Miss., 7th.

Birds.—*Geese*—Princeton, Cal., 3d; Mt. Sterling, Ill., 13th; Creswell, Kan., 6th, 10th, flying S.; Ft. Madison, Iowa, 3d, 4th, 10th, 14th; Independence, Kan., 26th, S.; Somerset, Mass., 28th, S.; New Bedford, Mass., 19th, S.; Springfield, Mass., 6th, S.; Waltham, Mass., 19th, S.; Oregon, Mo., 2d, 5th, 16th, 17th; Corning, Mo., abundant during month; no movement yet to the south. Ashley, Mo., 30th; Starkey, N. Y., 28th, S.; Flushing, N. Y., 3d, S.; Bellefontaine, Ohio, 24th; Tioga, Pa., 5th, S.; Cleveland, Ohio, 29th, S.; Cairo, Ill., 7th, 28th, S.; Tybee Island, Ga., 8th, S.; New River, N. C., 11th. *Ducks*—Daytona, Fla., 1st, flying S. in large flocks; Monticello, Ia., 13th, 26th, S.; Corning, Mo., abundant during month; no movement yet to the south; Starkey, N. Y., 11th; Fayetteville, N. C., 2d, 3d; Jacksonburg, Ohio, 24th, S.; Melissa, Tex., 2d, plenty; Ft. Gibson, Ind. Ty., 24th. *Blackbirds*—Elmira, Ill., 27th, numerous; Creswell, Kan., 15th, flying S.; Oregon, Mo., 1st to 3d, 7th to 11th, 13th to 15th, 26th; Wappingers Falls, N. Y., 2d, flying S. *Wild Pigeons*—Fayetteville, N. C., 2d, 3d. *Snowbirds*—Creswell, Kan., 25th. *Yellowbirds*—Ringgold, Ohio, during month. *Jaybirds*—Oregon, Mo., 10th; Palermo, N. Y., 11th. *Owl*—Oregon, Mo., 2d, 12th, 22d, 23d. *Meadow Larks*—Creswell. Kan., 27th. *Prairie Chickens*—Creswell, Kan., 28th, plenty *Buffalo Birds*—Creswell, Kan., 4th, leaving. *Quails*—Oregon, Mo., 1st. *Crows*—Creswell, Kan., 24th, 26th; Oregon, Mo., 22d; Bellefontaine, Ohio, 3d, flying S. *Cranes*—Oregon, Mo., 27th; Fayette, Miss., 1st, 4th, 21st, 27th, flying S.; Melissa, Tex., 1st, S. *Bluebirds*—Waltham, Mass, 4th, disappeared; Oregon, Mo., 1st, 17th; Starkey, N. Y., 13th, flying S.; Ringgold, Ohio, during month. *Robins*—Daytona, Fla., 26th, first seen this season; Fayette, Miss., 9th, first heard; Brookhaven, Miss, 6th; Starkey, N. Y., 3d, flying S.; Melissa, Tex., 8th, first appearance. *Eagles*—Wappingers Falls, N. Y., 23d.

Meteors.—Vevay, Ind., 12th to 14th. New Corydon, Ind., 2d, 14th, 23d, 26th, 28th to 30th. Fort Dodge, 16th, 8:15 p. m., very brilliant meteor of intense yellow color, exploded with a dazzling flash, but no noise; size twice or thrice that of Jupiter; after explosion a streak of greenish light remained visible for a second or two. Topeka, Kan., 17th, 7 p. m., brilliant meteor moved from near the zenith towards the southwest through a path of about 20°; size about twice that of Jupiter; color, orange red; 27th. Afton, Ia., 1st, 7th, 27th. Vail, Ia., 14th. Holton, Kan., 18th. Woodstock, Md., 15th, 8:35 p. m., meteor appeared in the west at a height of about 45° and traveled very slowly over an arc of about 30°; it was brighter than Jupiter; color, orange tinged with red on lower side; exploded into three parts, the largest the size of Jupiter; 1st to 4th, 12th, 13th, 23d, 24th, 29th, 30th. Owing's Mills, Md., 2d. Fall River, Mass., 6th, 26th. Rowe, Mass., 24th, 26th, 29th. Fayette, Miss., 3d, 4th, 6th, 19th, 21st, 23d. Oregon, Mo., 1st, 18th, 22d, 23d. Kansas City, Mo., 12th, 13th. Norfolk, Neb., 14th. Freehold, N. J., 14th. Atco, N. J., 5th, 15th. Linden, N. J., 29th. Jersey City, N. J., 24th. Waterburg, N. Y., 24th, 27th, 30th. Stankey, N. Y., 23d. Wappinger's Falls, N. Y., 1st, 13th, 24th, 26th, 29th. Flushing, N. Y., 24th. Jacksonburg, Ohio, 18th. Cleveland, Ohio, 23d. Strafford, Vt., 15th. Broad Oak, Va., 29th. Davenport, Iowa, 18th. Indianapolis, Ind., 2d. New Haven, Conn., 13th. Sacramento, Cal., 22d. Pioche, Nev., 29th, 30th. Boise City, Idaho, 23d, 26th, 27th. Breckenridge, 14th. Princeton, Cal., 10th, 8:30 p. m., meteor equal in size to Jupiter; appeared in the west at a height of 45°; 22d, 8 p. m., meteor, size, one-eight of full moon; appeared in the north northwest of a height of about 35° and moved to the west 60°, where it exploded; trail visible for three minutes, nearly as bright as day. South Hartford, N. Y., 1st, 5th. Cambridge, Mass., 14th, a brilliant meteor was observed to fall to the ground during broad sunshine, apparently at a distance of about ten rods from position of observer; the ground was examined, but nothing found resembling a meteoric stone. Brilliant meteors were also observed in Iowa; at Albion, on the 14th; Anita and Albion, 15th; Waverly, 16th, Decorah, 20th, and at Council Bluffs and Charles City on the 28th. Mr. E. F. Sawyer, of Boston, reports none on 23rd, 24th, 26th, 29th; cloudy on 25th, 27th, 28th, 30th; Bielas comet or meteor shower was expected on the 27th.

Polar Bands.—Bismarck, Dak., 16th; Savannah, 11th, 24th; New Corydon, Ind., 3rd, 10th, 14th, 15th, 19th, 29th; Tabor, Ia., 13th, 20th, 28th, 29th; Gardiner, Me., 3rd, 7th, 16th; Danville, Ky., 30th; Fayette, Miss., 2nd; Plattsmouth, Neb., 2nd, 20th; Auburn, N. H., 30th; Freehold, N. J., 9th; Vineland, N. J., 20th; Woodstock, Vt., 2nd, 16th; Wytheville, Va., 5th, 10th, 14th.

Zodiacal Light.—Savannah, 13th, 14th, 22nd; Southington, Conn., 14th; New Corydon, Ind., 1st, 2nd to 5th, 23rd, 24th, 29th, 30th; Monticello, Ia., 25th; Somerset, Mass., 14th; Oregon, Mo., 1st, 20th, 23rd; Contoocookville, N. H., 30th; Waterburg, N. Y., 2nd, 27th, in the morning; Cambridge, Mass., regularly looked for at 8 p. m., suspected on the 14th and 23rd, seen distinctly on the 24th and 26th: these four were the only evenings when the observation was not hindered by clouds or moonlight.

Prairie Fires.—Fort Gibson, Ind. Ter., 1st to 9th, 11th to 13th, (14th, many buildings and miles of fences burning,) 15th, (17th, nearly all fences burned in vicinity of National cemetery,) 23rd to 25th, 28th, 29th; Dodge City, Kan., 1st, 2nd, 20th, 29th, 30th; Pembina, Dak., 14th; Creswell, Kan., 1st to 7th, 12th, 16th to 25th, 29th; Independence, Kan., 3rd, 22nd to 24th, 28th; Topeka, Kan., nearly every night during month; Monticello, Ia., 30th; De Soto, Neb., nearly every day; Oregon, Mo., 13th, 18th, 22nd, 23rd.

Earthquakes.—Medellin, United States of Colombia, S. A., *September* 9th, 7:00 p. m., "single shock; no damage at this place, but at Manizales, 80 miles south of Medellin, several houses were destroyed;" 10th, 12:30 p. m., slight shock. Manizales, Antioquia, United States of Colombia, S. A., *October* 9th, (probably *September* 9th,) severe earthquake, 110 houses destroyed, including church, hospital and principal city buildings; no lives lost, as shock was long sustained, with principal force, at its termination. *October* 8th, Yokohoma, Japan, 10:48 p. m., slight shock; 9th, 1.20 p. m., smart shock, duration 45 seconds. San Jose, California, 11th, 7:30 p. m., severe shock, accompanied by a rumbling noise; vibrations from N. and S., lasting 30 seconds. *November*—San Francisco, 11th, 9:45 a. m., slight shock, with undulations, from east to west, and lasting about two seconds. Cairo, Ills., 18th, at 11h. 51′ 50″, "a trembling motion was felt, lasting 40 seconds, followed by a rocking motion from WNW. to ESE., lasting 20 seconds, and a second trembling lasting 10 seconds,"—houses distinctly felt to totter, and loose bricks were shaken from chimneys. Leavenworth, 18th, 11:15 p. m., slight shock, movement hardly sufficient to determine the direction, but it seemed to be from north to south. St. Louis, 18th, 11:57 p. m., slight shock, movement north to south, lasting but a few minutes and was felt only by persons occupying quiet positions in old buildings and in a few brick buildings, persons in the streets did not perceive the shock. Lebanon, Mo., 18th, a few minutes after midnight a severe shock, large brick houses trembling, awakening persons sleeping on second floor; vibration north to south, continuing for eignt or ten seconds, and followed by two lesser shocks, with six or eight seconds intervening; noise a low rumbling like distant thunder. Cairo, Ill., 19th, 5:10 a. m., slight trembling, lasting 20 seconds, houses tottered from WNW to ESE. Murphy, N. C., 23rd, 10 a. m., slight shock from west to east, lasting one minute, not much jar, but a rumbling noise like distant thunder. Panama, Nov. 7th, advices from San Salvador, C. A., report the volcanoes Izalco and Santa Ana in a state of great activity, and confirm the previous report of a severe earthquake in southern portion of the republic, resulting in great loss of life and property.

Sea Fog Wave.—The observer at New Westminster, B. C., reports the annual sea fog wave, (which he considers as the beginning of winter) to have made its first appearance this year on October 31st, at 4 p. m., barometer 30.04, temperature 49°; its first appearance occurred as follows, during the preceding five years:

Year	*Month.*	*Hour.*	*Barometer.*	*Temperature.*
1873.	October 27.	4:00 P. M.	30.23.	46°
1874.	" 31.	5:00 P. M.	30.14.	49°
1875.	" 9.	9:30 P. M.	29.93.	49°
1876.	" 9.	4:30 P. M.	30.00.	65°
1877.	" 19.	8:00 P. M.	29.86.	47°

Sunsets.—The characteristics of the sky at sunset, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from 123 stations show 3,682 observations to have been made, of which 37 were reported doubtful; of the remainder 3,140 or 85.3 per cent. were followed by the expected weather.

Sun Spots.—Monthly record of observations by Mr. D. P. Todd, Nautical Almanac office, Washington, D. C., communicated by Prof. S. Newcomb, U. S. Navy, in charge of that office:

Nov., 1878.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups	Spots.	Groups	Spots.	Groups	Spots.	Groups	Spots.	
1st, 4 p. m...	0	0	0	0	0	0	1	1	
2nd, 4 p. m...	0	1	0	0	0	0	1	2	
4th, 3 p. m...	0	0	0	0	0	0	1	1	
5th, 3 p. m...	0	0	0	0	0	0	1	1	
7th, 4 p. m...	0	0	0	0	0	0	1	1	
8th, 4 p. m...	0	0	0	0	0	0	1	1	
9th, 4 p. m...	0	0	0	0	0	0	0	0	
12th, 4 p. m...	0	0	0	0	0	0	0	0	
13th, 4 p. m...	0	0	0	0	0	0	0	0	
14th, 3 p. m...	0	0	0	0	0	0	0	0	
15th, 3 p. m...	0	0	0	0	0	0	0	0	
16th, 2 p. m...	0	0	0	0	0	0	0	0	
20th, 1 p. m...	1	2	0	0	1	2	1	2	Faculæ.
23rd, 4 p. m...	0	0	0	0	0	0	0	0	
25th, 2 p. m...	0	0	0	0	0	0	0	0	
29th, 3 p. m...	0	0	0	0	0	0	0	0	
30th, 2 p. m...	0	0	0	0	0	0	0	0	

Mr. John W. James, at Riley, Ill, reports that up to the 28th the sun spot, observed on the 3rd, had not reappeared. Prof. Gustavus Hinrichs, at Iowa City, Iowa, one very large spot observed from the 1st to the 8th. Mr. Jay Harcourt, at Wappinger's Falls, N. Y., observed one spot, on the 3rd, near the sun's centre, slightly below equator, very round and sharply defined; 4th, same spot, slowly rotating, changing its form to the shape of a kidney; 5th, slowly rotating towards the sun's circumference, 21st, 24th and 26th, sun examined, but no spots. Mr. David Trowbridge, at Waterburg, N. Y., examined the sun on the 1st, 2nd, 3rd, 4th, 5th, 9th, 10th, 12th, 14th, 15th, 16th, 24th, 29th and 30th; spots observed from the 1st to 5th, disappearing on the 9th. Mr. H. D. Gowey, of North Lewisburg, Ohio, observed spots on the 2nd, 4th and 6th, disappearing on the 12th by solar rotation; 26th, observed spot which might have appeared by solar rotation.

NOTES AND EXTRACTS.

Altitude of Meteors.—In the *Wochenschrift*, page 304, Torvald Köhl gives the altitude of twelve meteors simultaneously observed at two neighboring stations. Four hundred and eighteen meteors were observed in all, but only for these twelve could altitudes be computed; the results are obtained by Brandes' graphic method, and are as follows:

ALTITUDE IN GEOGRAPHICAL MILES.

No.	At the beginning.	At the end.	No.	At the beginning.	At the end.
1	10	11.6	7	—	14.0
2	15	12.3	8	—	5.0
3	—	9.3	9	16	—
4	—	10.9	10	11	7.0
5	—	13.0	11	11.5	10.0
6	—	13.6	12	15.25	13.5

Photographing the Clouds.—In a letter to the European Meteorological Congress, (*Wochenschrift*, p. 327,) Dr. Hildebrandsson urges universal attention to the motions of the upper and lower clouds, and adds: "The various forms of the clouds are, without doubt, of great interest, and their earnest study will certainly lead to important discoveries. But we must photograph the various forms of the clouds on a large scale, at different points in Europe, and note the different atmospheric conditions under which they occur. The studies executed in Upsala, with the assistance of an experienced photographer, have convinced us that these pictures can be taken in the majority of cases, even when the apparent motion of the clouds is very considerable. But it is, then, imperative to use extraordinarily sensitive plates, so that the time of exposure may last only a portion of a second. This is also the case when one would obtain good pictures of the small transparent cirrus clouds, whose photographic effect is but little different from that of the blue light of the sky. In this way we have, at Upsala, obtained an interesting series of photographs, which show how one form of cloud gradually passes over into another form." The Observers of the Signal Service have, since Nov. 1, 1870, made three daily simultaneous observations and reports of the direction of the winds and of the directions of movement of upper clouds at the different stations throughout the United States for purposes of study. In 1871 photographs of clouds were taken by the photographer employed at this office in connection with the meteorological instruments. In May, 1872, Assistant Cleveland Abbe,

A. M., of this office, reported the results of an especial examination and comparison of the direction of movement of the wind and the direction of upper cloud movement, as reported from the stations, and appearing on the manuscript charts of the office, thrice daily, for the period from January 1, 1872, to May 1, 1872, and later, in 1875, a further report on the subject was made by him, by direction of the Chief Signal Officer. The facts so ascertained and reported being, in effect, coincident with the facts announced, as to the different directions of movement of upper and lower air currents, by Buchan, Ley, Hildebrandsson and others. The field of study in the United States is large, and affords unusual advantages for studies of this description.

Increase of Temperature with Altitude.—M. Alluard communicates to the Paris Academy some of his experiences on the summit of the Puy de Dome, (4,850 feet.) He finds a great hindrance in the frost, which forms as readily as on Mt. Washington or Pike's Peak. He is planning to secure a large number of temporary stations at different altitudes in the neighborhood of Puy de Dome, and thus study horizontal sections of the earth's atmosphere. He finds not only occasional instances in which the temperature at the summit is higher than at the base, as has already been found to be the case at very many other stations, but so frequently does this occur that even the monthly means exhibit similar anomalies. The minimum night temperatures at the base are frequently 12½°, Fahrenheit, lower than at the summit; the maximum day temperatures show no such anomalies. He concludes that the rate of diminution of the temperature with altitude is very different during the day from the rate during the night, and hopes that future observations will give some clue as to the reason therefor.

A New Thermometer.—Joubert has determined very carefully the effect of heat in altering the rotatory power of quartz for polarized light. His experiments were made at temperatures of from —20° C. [—4° F.] to +1500° C. [2732° F.] Through which enormous range quartz proves to be exceedingly sensitive, and he proposes to reverse the problem and use the rotatory power of quartz as the best thermometer, convenient and comparable at all temperatures, that has yet been discovered. (Paris C. R., p. 499.)

Sun Spots and Terrestrial Meteorology.—Mr. J. A. Broun communicates to *Nature* (vol. 19, p. 6,) an investigation of the question does the barometric pressure vary in a decennial period; he examined particlarly the observations made in India since 1841, and presents the following conclusions: (1) The years of greatest and lowest mean annual barometric pressure are probably the same for all India. (2) Therefore the apparent relation to the decennial (sun spots) period found by Mr. Chambers for Bombay holds for all India. (3d) The annual oscillations of monthly mean pressure and monthly mean temperature (the amplitude of the annual variations) have nearly a constant ratio in India. (4) These oscillations depend on local conditions in the same latitude at places quite near each other, which are independent of the heat emitted by the sun. (5) The yearly mean isobars run parallel to the equator in India and are independent of local conditions. (6) The yearly mean isotherms vary in their direction with local conditions. (7) There is no relation between the variations of yearly mean temperature and yearly mean pressure.

Solar Radiaton.—W. Stanley Jevons communicates to *Nature* (Vol. 19, p. 35) a memoir, enumerating a very full list of commercial crises compared with the solar-spot periodicity, and adds: "I should point to the necessity of at once undertaking direct observations of the varying power and character of the sun's rays. There are hundreds of meteorological observations registering at every hour of the day and night the most minute facts about the atmosphere; but that very influence upon which all atmospheric changes ultimately depends, the *solar radiation*, is not, I believe, measured in any one of them, at least not in the proper manner." The various methods proposed by Pouillet, Herschel, Crova, Violle, Govi, Weber, Erman, Ericsson, Draper, Marie Davy, and many others offer to physicists a wide range of investigation into this important subject, which has certainly been neglected in the increasing demands upon meteorologists for weather predictions and practical results.

Edison's Tasimeter and Carbon Telephone as a Barometer or Hygrometer.—At the London Physical Society, November 9th, Professor W. F. Barrett stated that on replacing the hard rubber cylinder of the Edison tasimeter by a strip of gelatine varnished on one side it was found that a very slight change in the hygrometric state of the atmosphere can be detected by the absorption of moisture, causing expansion of the gelatine. By connecting the carbon button with an aneroid box the tasimeter becomes an aneroid baroscope; before any accurate measurements can be made, however, we must investigate more carefully the resistances of the button.

The Origin of Atmospheric Electricity.—Prof. Edlund of Stockholm communicates to the Swedish Academy the result of his researches upon "Unipolar induction," in which he has apparently made great progress towards the discovery of the origin and laws of terrestial magnetism, earth currents and terrestrial and atmospheric electricity. Although Edlund treats this subject by developing it in connection with his well known theory of the physical nature of that what we call electricity and magnetism, yet apart from this theory we may obtain some idea of his views in the following synopsis. The magnetic condition of the earth, as shown by observations upon its surface, may be approximately represented by assuming the existence of a great magnet somewhere in its interior and whose axis is inclined to the earths axis. Now the laws according to which a magnet acts upon magnetic bodies and magnetic or galvanic currents in its neighborhood can be clearly expressed in mathematical formulae agreeably to the known laws of magnetism and electricity, and Edlund finds that if we assume as we know is the case, that the magnetic earth is a good conductor of electricity then its action upon the moving atmosphere of oxygen, nitrogen and aqueuos vapor (which is also slightly magnetic and of which the vapor is a better electric conductor than the gas,) leads to the following rather rigorous deductions. (1) The earth will be negatively electrified. (2) Its potential will be everywhere

the same. (3) The atmosphere will be positively electrified. (4) The general equilibrum between atmosphere and earth takes place either by continuous currents or by discharge, but is hindered by the poor conductibility of the air and can take place only when favoring circumstances combine. (5) The atmospheric positive electricity will be strongest toward the equator and feeblest toward the poles. (6) Near the poles the negative electricity of the earth may even be, by dissipation, so distributed throughout the lower atmosphere as to feebly negatively electrise the air, as observed by Wijkander. (7) Owing to the feeble electrisation of the air in arctic regions, and to the absence of any opposition due to unipolar induction, there can be little or no lightning there, while thunder-storms will be most frequent in the equatorial region, where the resistances and potential are greatest. (8) The discharge by continuous current or aurora takes place in directions parallel to the free hanging magnetic needle. (9) At and near the magnetic pole itself the resistances to discharge are so slight, and the discharges are so favored by induction, that not even auroral light is produced. (10) The disruptive discharge between two bodies cannot take place except they be good conductors and be separated by a poor conductor; the dry air is the latter while water or the mass of particles of fog, and large drops of rain form good conductors. (11) By induction a negative cloud may exist in any locality, although the average condition of the atmosphere is positive. (12) The region of most numerous auroras must occupy a circle about the pole at such distance that the positively electrised particles of air flying northward are just able to overcome the atmospheric resistances and those arising from unipolar induction, which latter diminish with increasing latitude; this is also a zone in which the inclination of the magnetic needle is everywhere the same. (13) The direction of auroral coronæ should coincide only approximately with the magnetic needle, because the earths axis of rotation does not agree precisely with the magnetic axis. (14) The aurora should be most frequent where thunder-storms are least frequent. (15) The perpetual interchange of currents of electricity going to the poles through the atmosphere and returning to the equator through the earth produces a slight disturbance of the magnetic needle fully accounting for annual, daily and irregular variations. (16) Similar irregularities are produced by the varying conductibility of the atmosphere due to the variable quantityof its moisture. (17) The secular changes in the magnetic needle and atmospheric electricity appear to be due to causes outside of the earth.

Apparatus for Recording Atmospheric Electricity.—An apparatus for maintaining an almost continous record of the atmospheric electricity has been invented by Mascart, the Director of the French Bureau Central de Meteorologie, and has performed satisfactorily during several months at the Paris Exposition. Mascarts apparatus is described by Angot (*Le Nature*, p. 371). It is contemplated to establish these instruments in several different portions of France, and to study the laws of atmospheric electricity.

Moonsoons and Hurricanes of the Indian Ocean.—W. Wagner, chief of the first sub-section of the *Deutsche Seewarte*, communicates to the *Annalen des Hydrographie* a comprehensive review of our knowledge on this subject as contained in the works of Blanford, Meldrum, Wilson, Elliott, &c. From Wagner's memoir we extract the data given in the following table, showing the average characteristics of the hurricanes, cyclones or typhoons of Asia and India:

LOCALITY.	HURRICANES MOST FREQUENT.	DURATION OF PROGRESS.	DURATION.	ROTATION OF WIND.	DIAMETER.
Sea of China.....	September and October.	Toward W. and NW. when north of 20° N. lat. Toward S. and SW. when south of 20° N lat.; but exceedingly irregular and especially so between China and Japan and north of Formosa.	Eight to twelve hours; usually less.	Opposed to motion of hands of watch.	60 to 240 knots.
Bay of Bengal....	April, May, June, October, November, December.	Toward W. and N.	Several days.	Opposed.	100 to 300 knots; inner calm space 20 knots.
Arabian Sea.....	Very seldom.	* * * * * *	* *	* *	* * *
Southern Indian Ocean or Mauritius.....	February and March.	Toward WSW.; then S. and SSE., and finally SE.		Same as watch hands.	9–10 knots per hour for the fastest; 7–12 knots per hour for the slowest.

* Probably similar to those in the Bay of Bengal.

Barometric Pressure in Asia.—Dr. W. Köppen, of the *Deutsche Seewarte*, communicates to the *Annalen* an endorsement of Woeikof's statement, based on the preliminary result of the levelling across Siberia, according to which the altitudes of meteorological stations are greater by from 60 to 72 meters than has been hitherto accepted; therefore the mean barometric pressure, reduced to sea-level, is increased even more than was formerly assumed by Woeikof and Buchan.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

Brig. Gen. (Bvt. Assg^d.) Chief Signal Officer, U. S. A.

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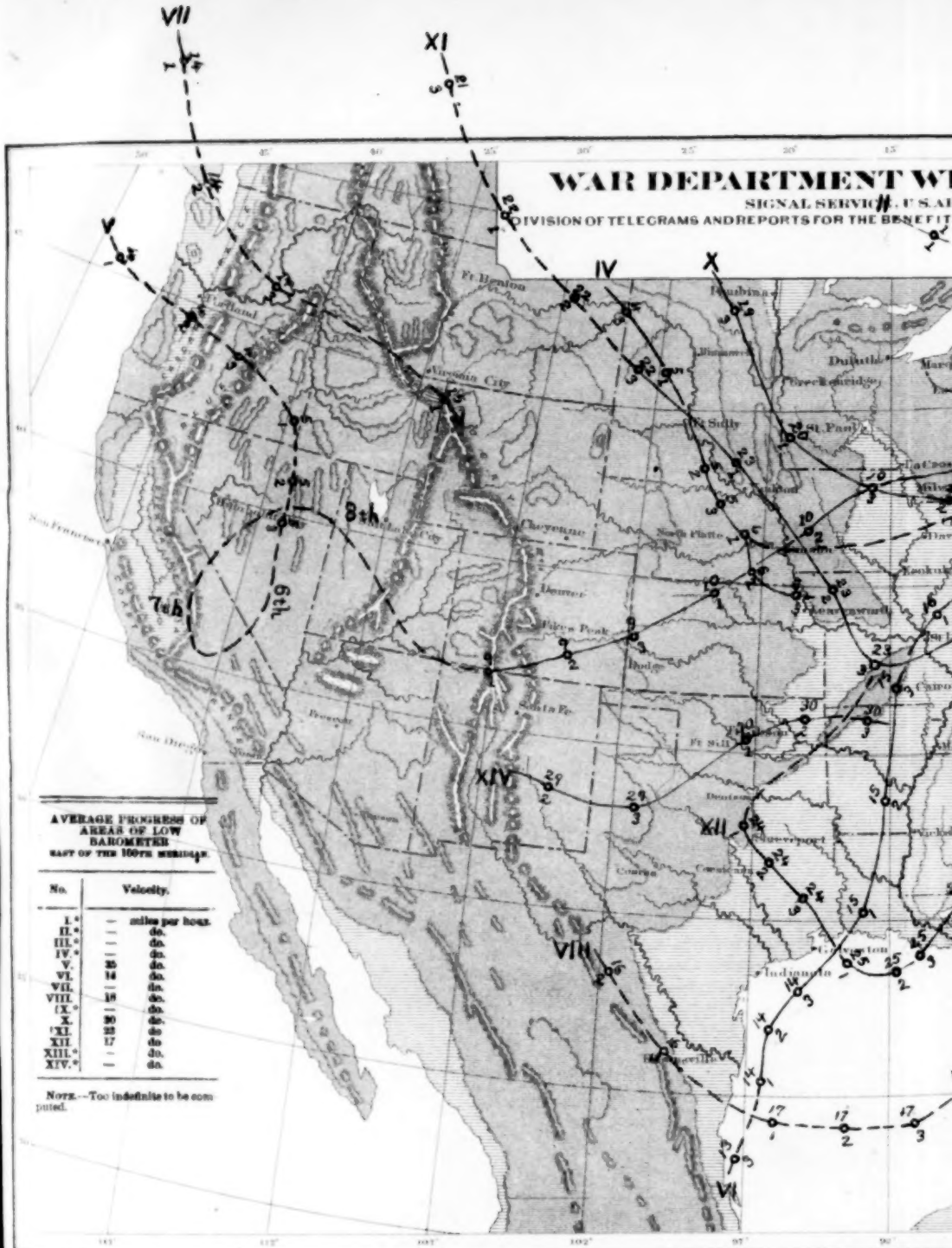
WAR DEPARTMENT W
SIGNAL SERVICE, U.S.A.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT
VII
XI
V
IV
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7th
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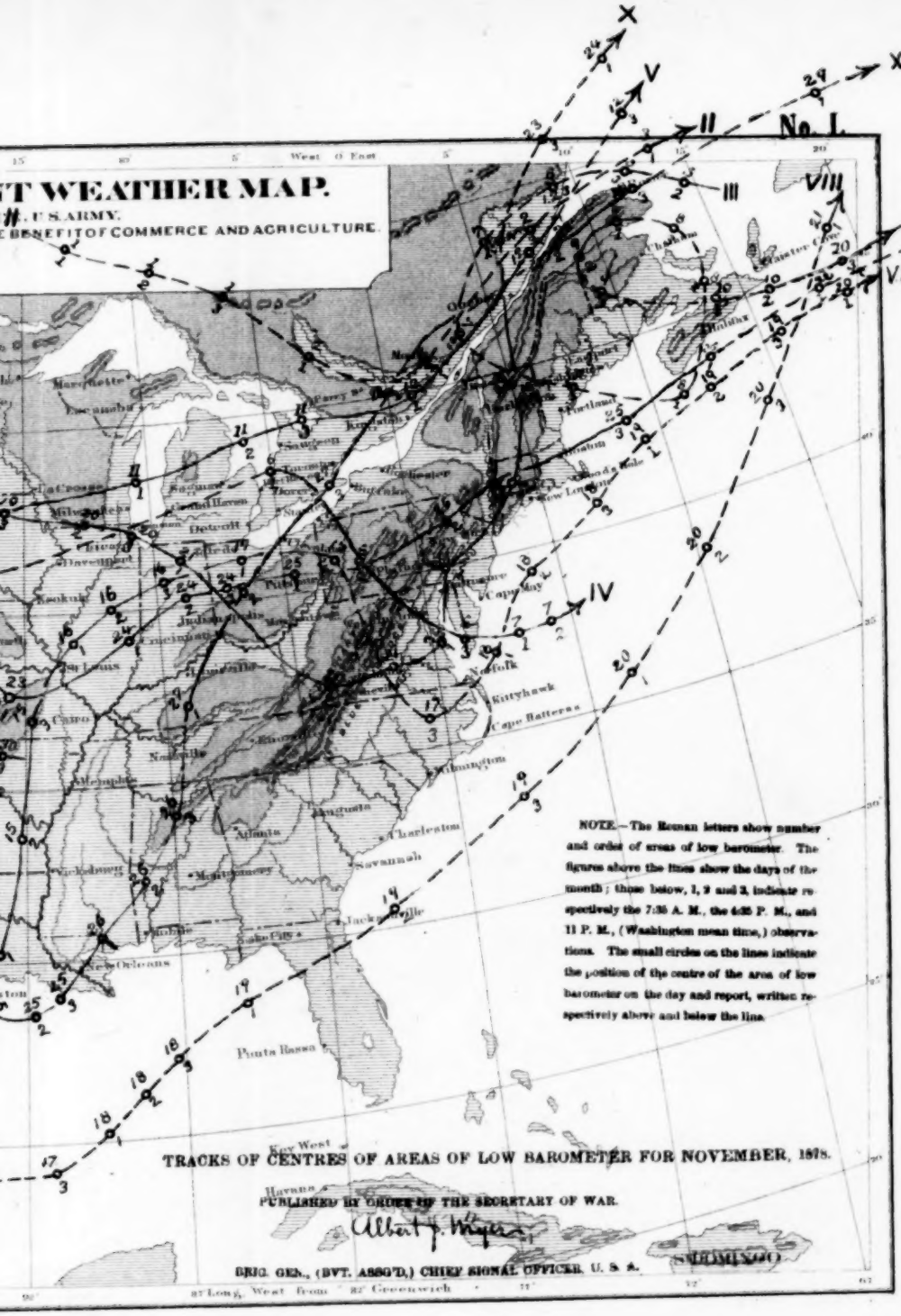
XIV
XII
VIII
VI
AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 105TH MERIDIAN.
No. | Velocity.
I.* — miles per hour.
II.* — do.
III.* — do.
IV.* — do.
V. 25 do.
VI. 14 do.
VII. — do.
VIII. 18 do.
IX.* — do.
X. 20 do.
XI. 22 do.
XII. 17 do.
XIII.* — do.
XIV.* — do.
NOTE.—Too indefinite to be computed.

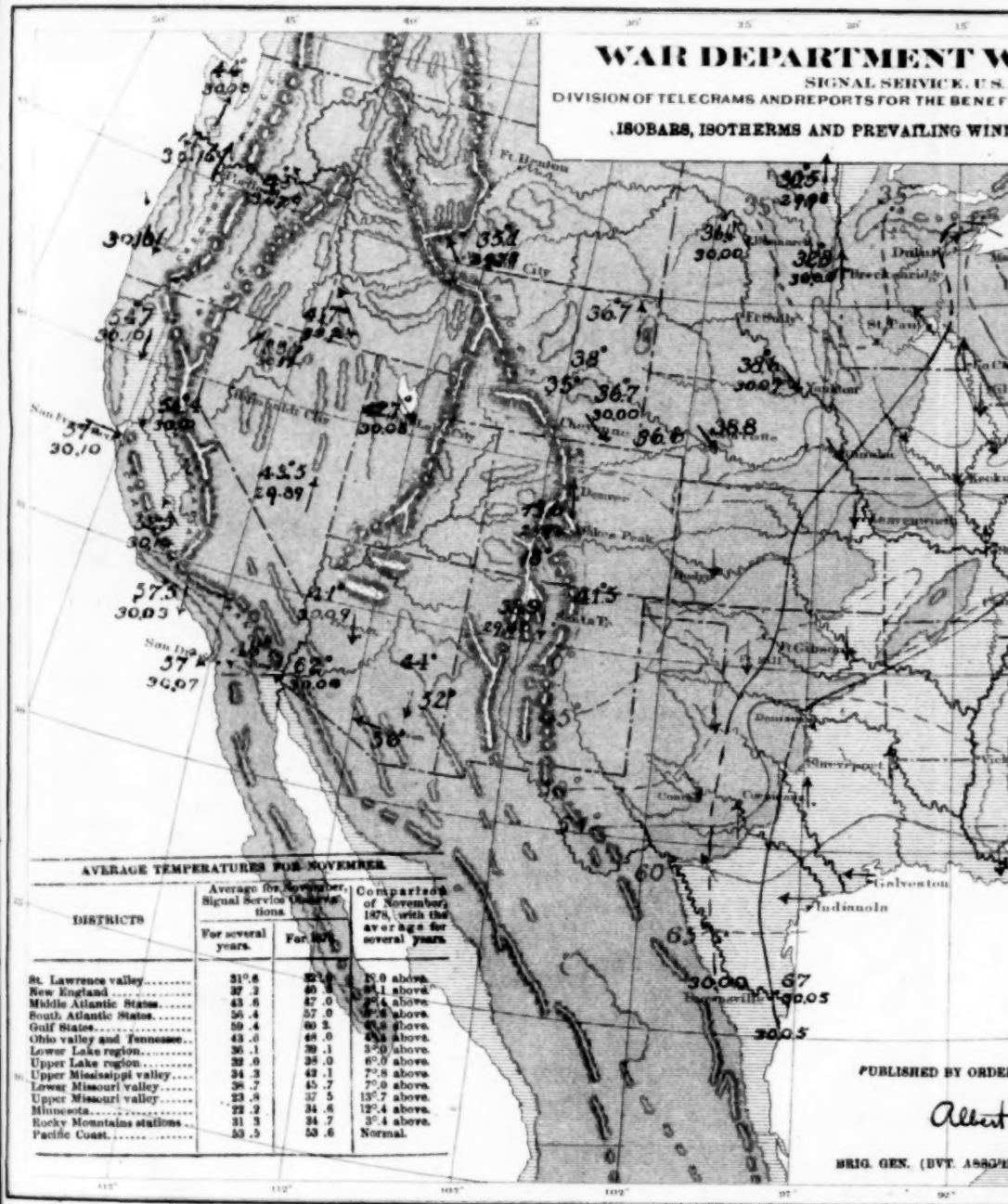


TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR NOVEMBER, 1878.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN., (BVT. ASSG'D,) CHIEF SIGNAL OFFICER, U. S. A.



AVERAGE TEMPERATURES FOR NOVEMBER.

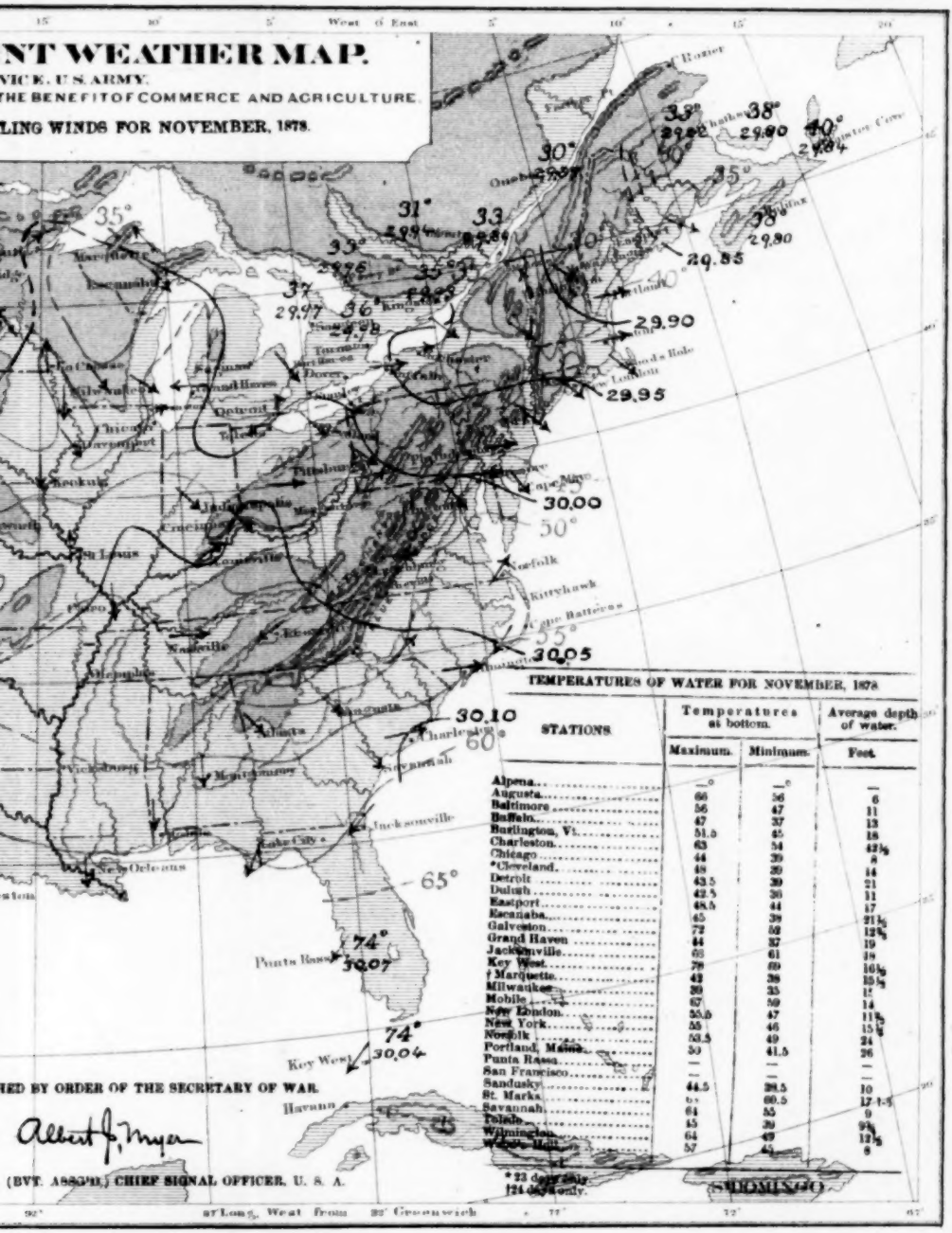
DISTRICTS	Average for November, Signal Service Observations		Comparison of November, 1878, with the average for several years.
	For several years.	For 1878.	
St. Lawrence valley	31°.6	32.0	1°.0 above.
New England	37 .2	40 .3	3°.1 above.
Middle Atlantic States	43 .6	47 .0	3°.4 above.
South Atlantic States	56 .4	57 .0	0°.6 above.
Gulf States	59 .4	60 2.	0°.8 above.
Ohio valley and Tennessee	43 .0	48 .0	5°.0 above.
Lower Lake region	36 .1	39 .1	3°.0 above.
Upper Lake region	32 .0	38 .0	6°.0 above.
Upper Mississippi valley	34 .3	42 .1	7°.8 above.
Lower Missouri valley	38 .7	45 .7	7°.0 above.
Upper Missouri valley	23 .8	37 5	13°.7 above.
Minnesota	22 .2	34 .6	12°.4 above.
Rocky Mountains stations	31 3	34 7	3°.4 above.
Pacific Coast	53 .5	53 .6	Normal.

NT WEATHER MAP.

VIC E. U.S. ARMY.

THE BENEFIT OF COMMERCE AND AGRICULTURE.

LING WINDS FOR NOVEMBER, 1878.



TEMPERATURES OF WATER FOR NOVEMBER, 1878

STATIONS	Temperatures at bottom.		Average depth of water.
	Maximum.	Minimum.	Feet.
Alpena	—°	—°	—
Augusta	66	56	6
Baltimore	56	47	11
Buffalo	47	37	13
Burlington, Vt.	51.5	45	18
Charleston	63	54	42½
Chicago	44	39	4
*Cleveland	48	39	14
Detroit	43.5	39	21
Duluth	42.5	36	11
Eastport	48.5	44	17
Escanaba	45	39	21½
Galveston	72	62	12½
Grand Haven	44	37	19
Jacksonville	68	61	18
Key West	79	69	16½
†Marquette	43	38	15½
Milwaukee	39	35	17
Mobile	67	59	14
New London	55.5	47	11½
New York	55	46	15½
Norfolk	53.5	49	24
Portland, Maine	50	41.5	26
Punta Rassa	—	—	—
San Francisco	—	—	—
Sandusky	44.5	38.5	10
St. Marks	65	60.5	17 1-2
Savannah	64	55	9
Toledo	45	39	9½
Wilmington	64	49	12½
Yorktown Hall	57	45	8

* 23 days' daily observations only.
† 24 days only.

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Albert J. Myer

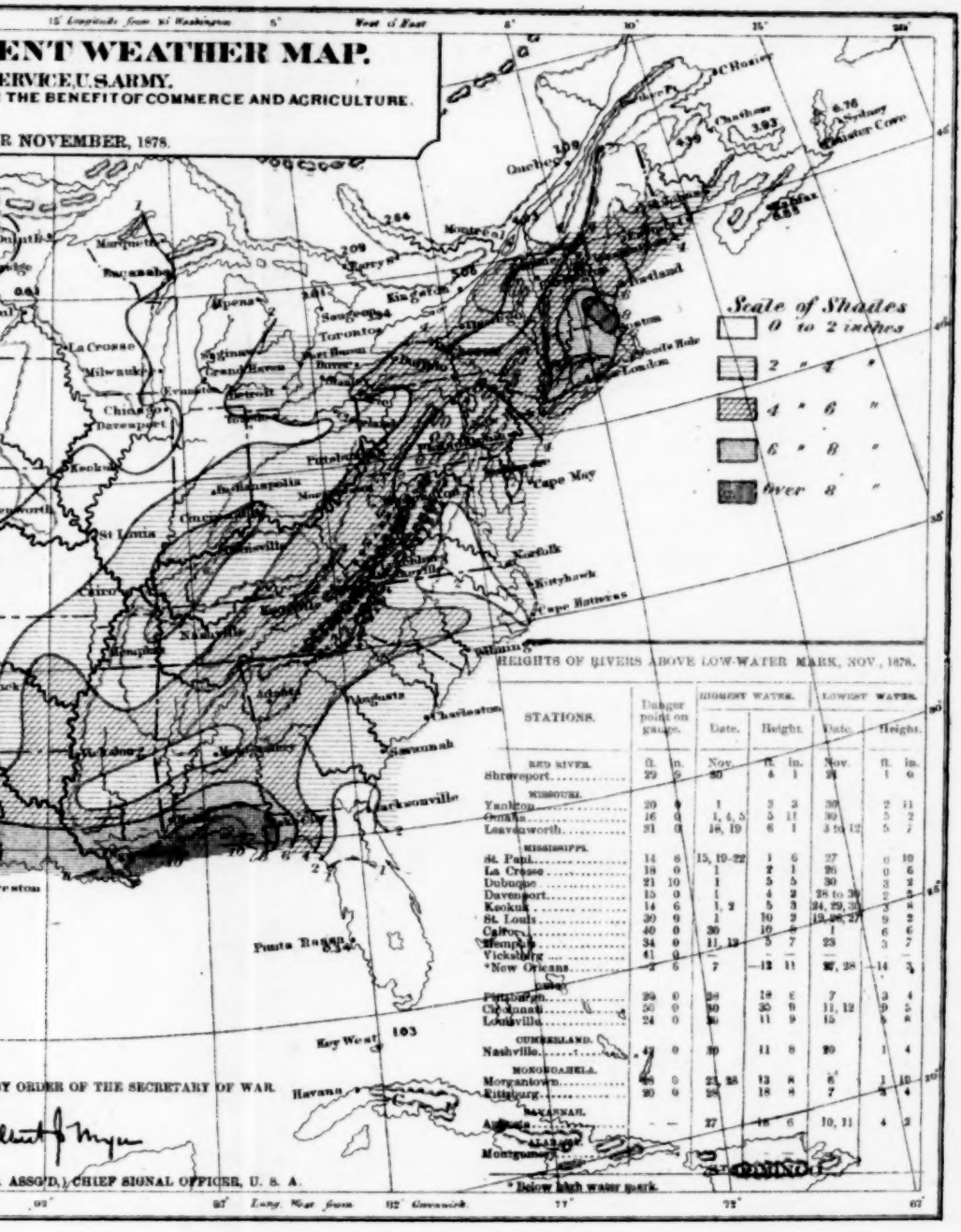
(BVT. ASSG'H.) CHIEF SIGNAL OFFICER, U. S. A.

SIGNAL SERVICE

at Long. West from 82° Greenwich

AVERAGE PRECIPITATION FOR NOVEMBER.

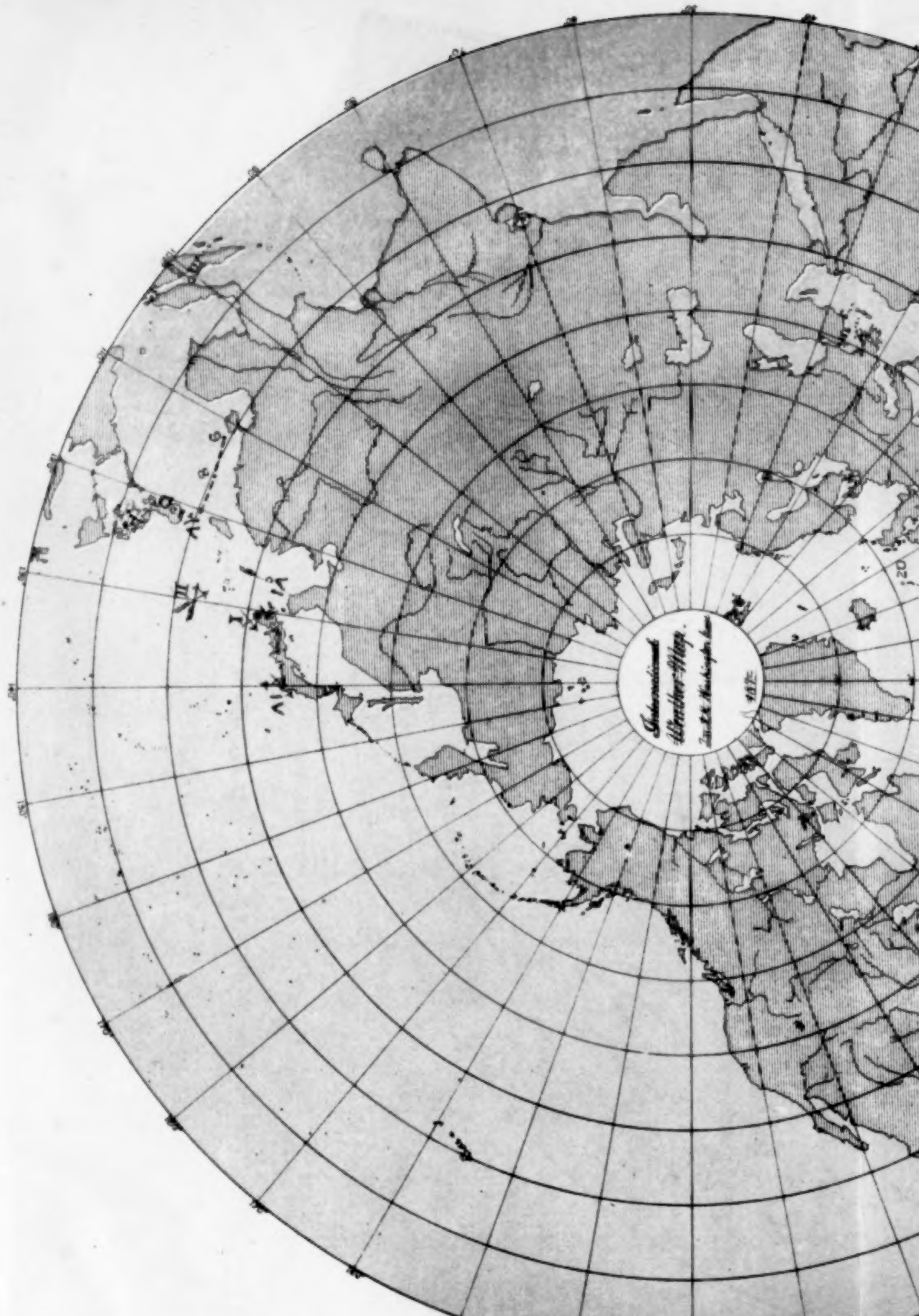
DISTRICTS.	Average for November		Comparison of November, 1878, with the average for many years.
	For many years.	For Nov., 1878.	
	Inches.	Inches.	
St. Lawrence valley	3.03	5.68	2.64 excess.
New England	4.15	5.44	1.29 excess.
Middle Atlantic States	3.45	3.27	0.18 deficiency.
South Atlantic States	2.90	2.98	Normal.
Eastern Gulf States	4.47	5.75	0.28 excess.
Western Gulf States	4.10	4.96	0.86 excess.
Tennessee	2.86	2.69	0.17 deficiency.
Ohio Valley	3.75	4.06	0.31 excess.
Lower Lake region	2.95	3.76	0.81 excess.
Upper Lake region	2.30	1.53	0.77 deficiency.
Upper Mississippi Valley	1.75	1.02	0.73 deficiency.
Minnesota	1.10	0.75	0.35 deficiency.
Lower Missouri Valley	2.15	1.14	1.01 deficiency.
Upper Missouri Valley	0.47	0.25	0.22 deficiency.
California Coast	1.60	0.98	1.62 deficiency.
Portland, Or.	7.95	5.61	2.34 deficiency.



HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, NOV., 1878.

STATIONS.	Danger point on gauge.		HIGHEST WATER.			LOWEST WATER.		
			Date.	Height.		Date.	Height.	
RED RIVER.	ft.	in.	Nov.	ft.	in.	Nov.	ft.	in.
Shreveport	29	0	30	4	1	24	1	0
MISSOURI.								
Yankton	20	0	1	3	3	30	2	11
Omaha	16	0	1, 4, 5	5	11	30	5	2
Leavenworth	21	0	18, 19	6	1	3 to 12	5	7
MISSISSIPPI.								
St. Paul	14	6	15, 19-22	1	6	27	0	10
La Crosse	18	0	1	2	1	26	0	6
Dubuque	21	10	1	5	5	30	3	2
Davenport	15	0	1	4	2	28 to 30	2	5
Keokuk	14	6	1, 2	5	3	24, 29, 30	3	8
St. Louis	30	0	1	10	2	19-26, 27	9	2
Cairo	40	0	30	10	6	1	6	6
Memphis	34	0	11, 12	5	7	23	3	7
Vicksburg	41	0	—	—	—	—	—	—
*New Orleans	2	6	7	12	11	27, 28	14	3
OHIO.								
Pittsburgh	28	0	29	18	6	7	3	4
Cincinnati	50	0	30	25	9	11, 12	9	5
Louisville	24	0	30	11	9	15	5	8
CUMBERLAND.								
Nashville	42	0	30	11	8	29	1	4
MONONGAHELA.								
Morgantown	18	0	23, 28	13	8	8	1	10
Pittsburg	20	0	28	18	8	7	3	4
SAVANNAH.								
Augusta	—	—	27	18	6	10, 11	4	2
ALABAMA.								
Montgomery								

*Below high water mark.


International
Weather Map.

INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS

Broken or dotted lines indicate that the lines so broken are doubtful.

Arrows, when charted, fly with the wind and exhibit wind-direction.

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THE HELIOTYPE PRINTING CO. 220 DEVONSHIRE ST. BOSTON